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Toward A Behavioral Ecology:

A Psychological Systems Approach to Social Problems

by

William S. Dockens III

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TOWARD A BEHAVIORAL ECOLOGY

A Psychological Systems Approach
to Social Problems
Inaugural Dissertation
by
FL William S. Dockens III
STOCKHOLMS NATION

at the University of Uppsala
Faculty of Social Sciences
to be discussed publicly in lecture room VIII
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William S. Dockens III

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K L Beckmans Tryckerier AB, Stockholm

I believe that there are certain principles in common in an emerging psychology of man or, as we should rather say, in a new science of man or general anthropology, because this will obviously be an interdisciplinary enterprise including biology, psychiatry, sociology, linguistics, economics, the arts and other fields. (Marshall McLuhan & Quentin Fiore §)

War and peace in the global village

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A QUESTION OF PRIORITES: A Preface

Events in the 20th Century have, so far, lead to more enigmas in social science than to revolutions. As knowledge in physics and biology surged ahead, creating new problems with their burgeoning technologies, the heirs of neither Wundt's precision nor Freud's insights have succeeded in making social science more than a slight appendage on the body of knowledge. Far from erobling man's humanistic image, the disparity between development in the natural and social sciences has lead to a general cynacism with respect to both social science in particular and all sciences in general. As nineteenth century cynacism is best typified in literature by Shelly's Dr. Frankenstein and his advanced applications of the theories of physics and biology which resulted in a socially and physically destructive monster, so the arguments of modern cynics have been supported by the destructive use of systems technology, atomic power and human resources to carry out acts which could easily be attributed to a collective social infantilism.

At first glance, the problem would seem to be one of priorities. It appears that governments and citizens of governments would prefer to read Freud, Rogers and Skinner, while supporting Von Braun, Teller and Salk. The hypothesis seems to be borne out by the fact that there are no Nobel Prizes in social research. The honors social scientists seem to earn from the society are those acquired from sympathetic

colleagues, or greatful publishers. The question could be raised: Is the present plight of social sciences due to the priorities of the society, or the priorities of the social sciences themselves? Has not social science, perhaps by its choice of problems, begun to find itself placed in a class with many forms of classical music, where a few private and governmental agencies recognize a traditional value, while youngsters and the masses, though copying certain themes, dance to more modern--more relevant--rythms? I think so.

After being born in a segregated hospital, witnessing over a dozen violent deaths, living in an area where an open sewer was allowed--for several years--to flow like a meandering brook through a rat infested dump, I felt that social science should at least have something relevant to say about the problem. After spending months in libraries pouring over methods and literature, it seemed reasonable to expect that I could offer some suggestions to the residents of one neighborhood where I spent five years of my life, some suggestions as to what to do about 36% of the people, mostly young people, who were suffering from drug addiction. In these areas, the areas where I grew up, there has never been a shortage of data or statistics. The lack has always been in the solutions to problems that are so schockingly apparent to the naked senses that they stink when smelled, appal when viewed and handicap when experienced.

By the latter part of the Eisenhower administration, my problem, "the problem of the metropolis" as it was later to be called, had developed to such huge proportions that the U.S. Government assigned the task to a "think tank" group at the Professional Services branch of the National Institutes of Mental Health at Bethesda Maryland. The project was directed under the leadership of Dr. Leonard J. Duhl, who assembled a group of professionals, from a wide range of disciplines, who went by the title: Conference of Social and Physical Environmental Variables as Determinants of Mental Health.

Experience gained from attempts at rehabilitation of European metropolitan areas at the close of the Second World War played a major role in the selection of participants which included psychologists, psychiatrists, socio-anthropologists, sociologists, city planners, phi osophers, newspaper reporters, mathematicians, a supreme court judge, pharmacologists, biologists and members of ther disciplines whom were chosen as much for their ability to work in an international interdisciplinary group as for their competetence in their own respective fields.

Fortunately for me, Dr. John Calhoun, the participant responsible for the collating, editing and publishing the conferences asked for assistance during the summer of 1959. I applied minutes after I heard that the position was open, though I must admit, I entertained little hope of being accepted. Indeed it came as a great surprise to both Dr. Duhl and me when we learned that the library work and

education that I had directed toward "my problem" was sufficient to make me familiar enough with the methods and language of the disciplines of the conference so that I could fit in quite well as Dr. Calhoun's assistant.

To this day, I don't know if it was by accident or design, but the influence of Leonard Duhl and his "Space Cadets" (the abbreviated code name for the Conference of Social and Physical Environmental Variables as Determinants of Mental Health group) not only destroyed my adherence to the psycho-analytic schools, it made it totally impossible for me to think in terms of psychology without viewing psychological systems from the standpoint of their relationships to the systems of other disciplines. Within the framework of "the problem of the metropolis" my old ghetto problem took on new dimensions, dimensions that forced me into a multidimensional world that was far beyond anything anticipated by the institutions that were responsible for my education, or the motivation that I had acquired from growing up with several of the gross aspects of the problem.

If such an exposure was not enough to bring about social, professional and cultural shock, taking over full responsibility for Dr. Calhoun's job the following year certainly arranged the contingencies for me to experience the complete impact of what was for me an intellectual cataclysm. Four years of reading and rereading the twelve volumes of the conference had to be supplemented by additional study of scientific methodologies and philosophies of many, often divergent, disciplines. Articles formulating the concepts

that eventually found their way into the manuscripts of the conference had to be read collated, and at times interpreted. The intimate relationship with the concepts and personalities of the participants was bound to leave me with biases which I would like to list here and refer to as "impressions."

The single most powerful"impression" has been the total ineffectiveness and impotency of one discipline approaches when they are applied to even the simplest problems involving the individual and his relationship to a modern metropolitan environment. This relationship is most probably best described as a series of interacting systems which are dynamic, complex, but most likely lawful. Though learning and communication seem to be the key disciplines to understanding the structural organization at the level of social science, physical, environmental and biological variables are of critical importance. Indeed, it is the gap between physiology and sociology which all but destroys a basic continuity hypothesis which seems to underly all systems formulations.

In order to apply systems techniques to <u>real</u> social problems, some method of ordering the disciplines into an effective delivery system must be formulated and tested. If the aim of systems is description, then the structural and conceptual hiatus between physiology and sociology may be filled with hypothetical constructs and glossed over by use of powerful mathematical-statistical formulations. Tests then become a question of predictive value. But the price of this negligence will prove quite extravagant if the

predicted outcome is clearly undesirable and leads to consequences which are best avoided. The modification, change or redirection of the system then becomes necessary. This implies that manipulable variables are an essential goal of applied social research.

Experience has clearly shown that it is possible to achieve temporary solutions without considering variables from the hiatus. It is possible to design machines that force humans to adapt to tenuous relationships between themselves and environmental contingencies. It is possible to build dwellings, hospitals, offices, education systems and even cultures without taking proper consideration for the variables with units between physiology and sociology, but by building such systems, the variables are still influenced--usually unpredictably.

This lack of predictability is apparent in urban renewal projects, rehabilitation programs, educational systems where buildings stand empty, patients relapse and students drop out--dispite the care taken in manipulating other variables. The following pages are devoted to the theoretical and practical problems of constructing a behavioral system that can be applied in conjunction with systems from other disciplines. Since some of the systems are not sufficiently quantified, an ecological approach is given priority over the more mathematically oriented General System Theory of Bertalanffy. An inductive system was integrated with hypothetical deductive systems and made to work, but in a way that may cause some trouble to General Systems approaches to synthesis. It is however reasonably compatible with the modern ecological

approaches which seem to be evolving in biology.

The application of systems to social problems naturally demands a rather strict systematization but the system or systems are not given the top priority. This is reserved for solutions to THE PROBLEM!

CHAPTER I

THE PROBLEM: An Introduction

Structures, Models and Communication.

The problem is to find a method of constructing effective delivery systems for the application of scientific knowledge and technology to current metropolitan problems. Since the knowledge that we have is in the form of systems, facts, theories and statistics scattered throughout a myriad of different disciplines and professions, compatiblity is added to a long list of stringent requirements. The approaches most often applied to problems of data collection, interpretation of findings, communication between disciplines and administration of the operations necessary for application of techniques are: eclectic, intedisciplinary and ecological procedures.

Since few individual investigators are competent to collect, judge and utilize relevant data from more than one or two related disciplines, modern information explosions have often burried would be eclectics under a pile of data from competing and overlapping systems. The disadvantages of lacking a suitable frame of reference becomes even more critical as institutions become larger, populations more

transient and the demands, both linguistically and conceptually, become more acute. In the face of these contingencies the limitations of the eclectic approach become more than apparent.

The choice between interdisciplinary and ecological approaches is however, a little more difficult than choosing between either of these and the now obsolescent eclecticism. Unlike the eclectic approach, both the interdisciplinary and the ecological approaches are capable of encompassing the full range of knowledge and data in any and all areas. The superiority of the ecological approach lies in its ability to integrate the various disciplines within a single frame of reference. Since this integration is done through a structural analysis of the field, problems of communication so common in interdisciplinary research, as well as biases within disciplines are more easily overcome by use of ecological methods.

According to Auerswald (1969), the accumulation of data within an ecological framework is a sequential process involving the collection of information or data, the ordering of the data within a selected framework, analysis of the data, synthesis of the results into hypotheses, and the construction of a delivery plan for use of these strategies and techniques. Auerswald's formulation can be made more general by formal application of systems and use of a structural analysis of both the problem and the disciplines dealing with the structures. Failure to make such an analysis has often lead

to the acceptance of borrowed analogies which remain sterile do to their lack of manipulable variables.

But the selection of the systems to be included in collecting and evaluating data is not altogether arbitrary, though many treat the problem of system selection as if it were. A structural analysis greatly reduces the number of options as to which systems to choose. Add to this a requirement that the ecologist be able to alter or manipulate classes of variables and the options become limited to a point which approaches most definitions of "objectivity."

Science, Systems and Psychology.

The relationships between scientific developments and the Zeitgeist are such that it is often impossible to distinguish between actual advancements and periodic prejucices, prejudices that like fads of fashion are limited in both scope and value. The period in history since the end of the Second World War can be called the "Age of Systems." And in an age of systems, prejudices which include systems "naturally" seem more "plausable." This "natural plausability" should, however, be tested quite carefully to determine whether it is the data or the fad which produces the appearances of validity. This caution is especially necessary in a discipline like psychology, where the proclivity for accepting faulty analogies seems only to be exceeded by the ability to misuse and misinterpret them.

The translation (or mapping) of psychological variables into the language and procedures of general systems is a task fraught with difficulties. Part of the difficulty lies in the fact that psychology as a discipline lacks the prerequisite continuity which seems to be so essential for adequate communication, language and nomenclature. Add to this the fact that many of the important areas of psychology use units that in addition to being difficult to quantify, lack specifiable relationships with units of other disciplines; and the problems become difficulties of the first magnitude. Fortunately, a reformulation solves many of the problems.

The first problem is to find an answer to the question: What is a system? If a set is said to be a class of objects that can be defined by either listing its members or stating the properties or rules governing the admission of members to the class, and a unit is assumed to be the elementary set by which systems are defined, then a system (according to Miller, (1965)) is a set of units with the relationships between them. Miller uses a structural analysis to define three classes of systems: conceptual, concrete and abstracted. Since the distinction between these three classes of systems has lead to an important link in communication between several otherwise unrelated disciplines, the major points will be briefly reviewed.

A conceptual system is constructed of terms or symbols which act as its units. The relationships between these

terms are in turn expressed in terms or symbols. The observer is therefore free to select from an infinite number of these units and relationships with which he can construct sets, the members of which become variables of the conceptual system. A function is a correspondence between two variable sets such that a value of one depends upon a value of the other, as determined by some rule or relation. The state is the set of values, on some scale, that a variable has at a given instant.

A concrete, real or veridical system is a nonrandom accumulation of matter-energy, in a region in physical space-time, which is nonrandomly organized into coacting subsystems or components. The units (subsystems, components, parts or members) of these systems are also concrete systems. The relations in concrete systems are usually measured along spatial and temporal scales from which are derived the so called "causal" relationships. Similarity of types, fate, as well as proximity and patterning of units are the criteria by which an observer distinguishes a concrete system from nonorganized entities in its environment. (Campbell (1958)) Both units and relationships in concrete systems are empirically determinable by some operation carried out by an observer. Variables of concrete systems are also measured and determined by specific operations and are defined as a property of a unit or relationship within a system. Like the conceptual system, the state of concrete systems are represented by sets of values on some scale that are recorded at some instant in

time. The state of concrete systems always changes over time! The structure of a system is the arrangement of its subsystems and components in three-dimensional space at a given moment of time. (Weiss, 1958, pg 140) And all change over time of matter-energy or information in a system is process. The totality of all the structures in a system which carry out a particular process is a subsystem. The subsystem at the perimeter of a system, that holds the components together and admits or excludes various sorts of matter-energy information is the boundary of a system. Boundaries which are at least partially permeable belong to open systems. Boundaries that are impermeable (do not allow matter-energy or information transmission) are subsystems of closed systems.

An abstracted system is a system composed of relationships which serve as its units. The relationships are attributes of concrete systems. Miller makes the following distinction between the two systems. "A has the property r" is representative of a statement from a concrete system, while "r is a property of A" is an example of a statement from an abstracted system. Miller emphasizes the importance of this distinction by giving the example of trying to discover if "A has the property r" or looking for and finding an "A which has the property r." Conceptual systems are easily distinguished from the abstracted in that the former has no empirically determined units or relationships.

The immediate consequence of accepting the Miller formulation reviewed here as a basis for an ecological approach is that top priority is given to concrete systems, with biological systems occupying a central position which is supported by formulations borrowed from communications and behavior. While the linguistic advantages gained by such a tactic is indeed considerable, there exists also a considerable risk of being trapped by the communications analogy which will be reviewed below. Never-the- less, by treating disciplines as systems, and giving concrete behavioral formulations priority over communications and biology, it is possible to maintain the integrity of psychology against the constant conceptual pressure of other disciplines.

The relative importance of the systems in any practical situation can then be decided by the nature of a specific problem, and the availability of resources for the modification and/or manipulation of the respective structural units. Of course this raises a host of very difficult questions: Is there sufficient continuity between the systems in social science to effect such a strategy? And if so, how should it be expressed? What language? What logic?

Communication, Systems and Context

Unfortunately, treating language as an abstracted system does not answer all of these questions, especially if the systems are selected and deployed in the manner advocated

in most general system and ecological approaches. The heavy stress is usually placed on terminology, where Lyons (1968) says that scientists excercise their "right!"

> Every science has its own technical vocabulary: it is only because the layman takes on trust the established sciences, and especially the `natural´sciences, that he does not question their right to furnish themselves with special vocabularies. The technical terms used by linguists arise in the course of their work and are easily understood by those who approach the subject sympathetically and without prejudice. (pg. 1)

This opinion--which appears to be the prevailing thought in most disciplines--gracefully ignores the fact that most professional scientists are amature linguists. So their unskilled tinkering with terms in a language is very much like the teenage auto enthusiast who impressed by speed and power, destroys the back of his Volkswagen so that his bug can accommadate a 400 hp Mustang engine. It is no wonder then that only those who are "sympathetic" and "without prejudice" are willing to drive the resulting monster. All professionals like engineers (linguists and logicians) and auto makers are often as appalled by the combinations as they are shocked by the potential clamity that can occur with all the unbalanced power on display. Multiply this analogy by the disciplines involved in modern science and you have what amounts to a linguistic traffic jam of monster cars!

More specifically, the net result of the conglomeration of common language, spoken language, scientific language and

various ordering systems in the from of grammars, systems, syntaxes and logics has, since Einstein's (1916) theory of relativity, been a linguistic nightmare for any attempting to synthesize more than two systems. Bertrand Russell's (1921),(1925) attempt to combine the mathematical-philosophical concepts with advances in natural and social sciences did however lead to a burst of activity in the nineteen thirties. Part of this activity was directed toward correcting the conflict between new relativistic,dynamic, concepts of scientific terms and the absolute, static, quality of traditional language and logic systems. The three authors who due to their choice of systems are most germane to this work are Alfred Korzybski, Hans Reichenbach and B.F. Skinner.

Alfred Korzybski (1879-1950), an engineer turned semanticist ,founded the Institute of General Semantics, a movement that was a direct reaction against the Aristotelian structure of language and the semantic influence which Korzybski felt impeded intellectual development with its "lowest order abstractions." His studies culminated in Science and Sanity (1933) where he introduced a method by which modern structural premises could substitute an "actional, behaviouristic, operational, functional language," for the systemitized confusion of orders of abstraction which he believed to be inherent in the Aristotelian based languages of 1933. The formulation of General Semantics is said to be based on a General System of Time-Binding: "an ability to extend and summarize the manifold experience of many generations."

In addition to his consideration of disciplines within the context of a general system, Korzybski deals directly with the problem of "dual languages" which has resulted in one language for quantum mechanics and another language, with a different structure, for other branches of physics. He ignores, however, the inductive nature of quantum mechanics and accepts the "space-time" formulations as basic. The influence of Ivan Pavlov and C.S. Sherrington as well as the psychological theme, the continuity hypothesis, the unified system approach emphasizing wholeness, and the reliance upon mathematics as a basic pattern makes Korzybski's formulation both an interesting extension of the Russell-Whitehead approach and a linguistic precursor of Bertalanffy's General System Theory.

Philosopher Hans Reichenbach was--like Korzybski--influenced by the impact of physics and mathematics upon the structure of language, logic, philosophy and psychology. He accepted a behavioral formulation of psychology, but instead of a conventional space-time orientation, Reichenbach based his logical and linguistic formulations on those of the inductive, statistical approach of quantum mechanics (1944). His studies culminated in both a multivalued logic and a probabilistic epistomology which supported an inductive form of behaviorism (strongly influenced by Tolman (1935)) which he formulated in Experience and Prediction (1938). Reichenbach gives a more succinct generalization of the

inductive inference in The Rise of Scientific Philosophy (1951):

> A set of observational facts will always fit more than one theory; in other words, there are several theories from which these facts can be derived. The inductive inference is used to confer upon each of these theories a degree of probability, and the most probable theory is the accepted. In order to differentiate between these theories obviously more mustbbe known than the deductive relation to the facts, which holds for each of them. (pg 232)

The rejection of Aristotelian linguistic premises and the substitution of more mathematically oriented languages which can accommodate the more dynamic, multivalued, relativistic, behavioral formulations of 1938 are other points which the philosophy of Reichenbach shares with the Institute of General Semantics.

Some of the basic premises of B.F. Skinner's Experimental Analysis of Behavior have also been drawn from Russell's formulations:

> The clue to the definition of reflex may have come from Bertrand Russell. Somewhere, possibly in a series of articles in the Dial in the late 20's, Russell pointed out that the concept of the reflex in physiology had the same status as the concept of force in physics. Add that to Bridgman's treatment of force in The Logic of Modern Physics and you have the present point. (Skinner, 1961)

Perhaps Russell's influence is the explanation for the interesting resemblance between the formulations of Skinner and Reichenbach. Both differ from Russell in that they utilized the inductive inference instead of the hypothetical deductive methods of The Analysis of Mind (1921). Both express their behavioral formulations in terms of probability. And interesting enough, the year 1938 marks the publication date for Skinner's Behavior of Organisms and Reichenbach's Experience and Prediction where the psychological aspects of the respective systems are introduced.

The Skinnerian formulation shares the influence of E.C. Tolman with Reichenbach as well as the influence of Pavlov and C.S. Sherrington with Korzybski. The approach to language differs,however, in one important respect. The terms and relationships in Skinner's system are determined by an experimental procedure, which allows for the substitution of controlling variables for concepts. This option, together with the fact that the Analysis of Behavior is easily translated into symbolic logic systems used with computers,facilitates the use of Skinner's system in both the theoretical and practical aspects of ecological systems.

It becomes evident from the review of the Korzybski, Reichenbach and Skinner formulations that the introduction of an inductive system into an Aristotelian based language leads to a structural pressure (a tendency to regularize the "anomalies" in accordance with the general patterns of the language (Lyons 1968)) that intereferes with both logic and communication between subsystems of the complex. Where Korzybski avoids the problem of induction, both Skinner and Reichenbach offer similar solutions to the epistomological problem. These solutions will be applied to language problems as they occur in the following pages.

Ecology and the Problem of Survival

In addition to problems in communication and logic, the construction of ecologically based delivery systems present general methodological problems which have been outlined by Duhl (1960). It is best to begin with his

definition of "disease":

> The normal biological, psychological, or social means of coping with the stresses of the internal and external environment becomes defined (by persons given the authority, consciously or not) as disease only when the individual or group's biological, psychological, or social survival is jeopardized and some permanent or semi-permanent damage to the psychosocial or biological functions of man occurs.

This definition is an accurate description which extrapolates the biological model into a social context. In addition to meeting the standard criteria of pathology outlined in most modern medical textbooks, it clearly avoids the weaknesses criticized by behavioral therapists and modifiers like Ullmann & Krasner (1969), Bandura (1969) and Yates (1970).

Duhl's formulation fo the "etiology" of disease is consistent with the ecological definition:

> The results of research and observations have made it clear that man is the product of a continual learning process in which he biologically and psychologically learns to adapt to experience. In the continual process of adaptation, the basic constitution is modified by the external environment. Increasingly, the external environment is being created by man and is affecting man in innumerable ways. Clearly the etiology of disease cannot be considered to be due to single factors, but rather to the combinations and permutations of multiple factors ranging from individual biological differences, to environmental differences, and to the processes of interaction between individuals. (Duhl, 1960)

The organized complexity implied from these formulations is, according to Duhl, much more than the physical and social environment of the individual, it is the total internal and external series of relationships, which includes man as part of an ecological network which modifies and is modified by human behavior.

In addition to giving social, biological and natural sciences a common reference point, the Duhl formulation acknowledges the central position of learning, while at the same time linking adaptiбn, learning, the biological processes and general ecology. An important implication that can be drawn from the ecological formulation is that learning, though central and important, must be considered within the context of a much larger, more complex, ecological field. And if design of cultures is a necessary goal for a science of behavior, it is important, indeed critical, that this science function in conjunction with other disciplines in this field.

Research problems within this context differ from those traditionally associated with psychology and psychiatry in both scope and complexity. Those given high priority in the Duhl formulation are stated as follows:

1. Nomenclature. Despite our ecological view and recognition that adaptive patterns are more important than disease entities, nomenclatures allow us to develop many studies useful to clinical and administrative understanding and for the development of programs of prevention. The APA Nomenclature needs major revision reflecting our current knowledge and the needs of the researcher, administrator, and clinician.

2. As part of nomenclature but more than it, is the total problem of communication. Our scientific language, especially in our field (psychiatry,wsd iii) is archaic in its ability to communicate meanings to others. The vast knowledge being gained by science is lost to us without effort, for it passes us by as if it were in the language of another world. No more needs to be said but that we must work on this and the part we play in it.

3. A general and more complete reporting of our activities can only lead to more adequate understanding. This means reports from hospitals, clinics, private psychiatrists, and others seeing prychiatric problems integrated in a central reporting system, with adequate safeguards for confidentiality.

4. Morbidity studies, or the study of the incidence and prevalence of illness of total populations, are required.

5. We need spot checks of disease in communities and hospitals to tell us the extent of disorders at given periods of time. Repeats of such studies give us clues as to change.

6. Repeated cohort studies. Following groups of patients over a period of time and then repeating studies will reveal many of the variables involved.

7. Usage studies. How are people cared for? What do doctors, and other parts of the population, consider disease? To know what conditions are cared for and by whom gives us clues to the truer understanding of the impact of our actions. Who gets well? Under what treatment, or none?

8. Ecological studies of treatment. What are all the many factors involved in treatment other than the obvious?

9. Problem of name changing. How have our disorders been renamed? How do we change our preceptions of disease?

10. Multiple disease morbidity. Only by looking at multiple indices and their relationships can we see if and how supposed treatment leads to new disease, and how one disease is related to another: in families, by geography, or by many other factors.

The Ecological Context.

Duhl's formulation of disease, etiology and ecology immediately brings the problems of social intervention into sharp focus. It does this by pointing out that man, like many other organisms on this planet, is a product of an interaction between his biology and his environment, with learning acting as the chief mediating process. Man's primary adaptive pattern has been to gradually gain increasing control over all three factors. The combination of social and political events with the communication process

has resulted in a growing concentration of this control in highly centralized systems lead by relatively small groups of people.

As knowledge and efficiency increases, so does the threat that some group, or groups, might excercise control over relevant variables to create an environment which is highly biased in favor of the groups' own "survival." Then by labeling individuals and other groups as "deviants" and applying the knowledge of controlling variables (biology, learning, communication etc.) the "in" groups could perpetuate both itself and the system.

Whether this threat is real or imagined is debatable. Never-the-less, within this context, the psychiatrist can often find himself trying to defend a position somewhere between the individual and the established systems, a position that becomes increasingly vulnerable from both sides as the stresses of modern society place increasing pressure on both systems and individuals. The psychiatrist may answer from an ecological frame of reference: "You are doing this to yourselves!" But because most objective methods of evaluating individuals in this context are inadequate for dealing with modern systems, social scientists can offer few suggestions as to what should be done "instead."

Since the facts concerning ecological problems are scattered throughout a myriad of different disciplines and professions, multiple skills must be enlisted. Since these skills are organized within certain institutional systems

problems of communication and administration arise. Since each of these professions, disciplines, as well as the social groups to which patients and professionals belong have excercised their "rights" to have different languages, some interdisciplinary language must evolve or be created. Since the languages have different inherent patterns and structures, a form of systems logic which can accommodate these different structures must be employed.

Even with the help of relatively good communications systems, some overlap, as well as conflicts will arise, These will require some system of co-ordination and/or mediating system. All of these contingencies combined add up to the ecological context within which effective scientific delivery systems must be fashioned.

Psychology in Context

What does the ecological context demand of the experimental psychologist? It demands a learning system (theory) with which to explain and alter the relationships between living organisms and their environments. It demands ways of defining and testing relationships so as to ascertain what behaviors effect survival and to what degree. It demands ways of creating and objectively evaluating environments within the framework of psychology. It demands that experimental psychologists participate in the design and administration of new environments. All this it demands of a discipline that is itself in greater dissary than the multidisciplinary ecological context to which it is asked

to make contributions toward--order!

No unified field theory has emerged yet from the discipline of psychology--quite the contrary. An analysis of the units, methods and relationships in this field reveals structures and units so varied and divergent as to suggest that psychology is not one discipline, but many. Unlike the systems in natural science and biology, continua in psychology are few and far between, with many areas that are still not quantified. In addition, the discrepancy between theoretical, experimental and applied areas in many branches are so great as to sometimes justify the use of the term "unrelated." It is not surprising then that relationships between the various branches of psychology and the other fields which study the ecological net vary so greatly so as to make areas like physiology and physiological psychology bear much more resemblance to each other than most branches of clinical psychology and learning psychology.

The relationships between clinical and learning psychology, and between experimental and applied branches are sufficiently important to the application of the discipline to ecological problems as to make some sort of synthesis mandatory. Equally important, are the relationships between the various branches of psychology, and the many other disciplines which are required in solutions to ecological problems.

The Problem in Context

Within the constraints of the systems, linguistic and ecological formulations listed above, an attempt will now

be made to apply a modification of Auerswald's (1969) ecological method to the field between physiology and sociology. The theoretical base and delivery system that evolves from this procedure will then be tested against natural conditions and evaluated as to effectiveness and plausability.

Summary.

The relationships between modern man and his environment have become too complicated to attack within the framework of a single discipline. However, the introduction of multiple-disciplinary approaches also raises problems of language, logic, communication and administration. Some of these problems can be solved by adopting an ecological approach by which a unified delivery system might be constructed. But there are still certain stresses which might become manifest in the delivery systems, stresses introduced by terminology, inductive systems, and time factors.

A careful systems formulation and a strict adherence to concrete systems as a theoretical and applied base can go a long way toward moderating the structrual effects incurred by interactions between disciplines with different premises. Defining the terms and procedures within the ecological context can also prove useful in facilitating co-ordination. But there is a continuity hypothesis that lies dormant in all systems formulations. The contingencies of this continuity have to be met by either a field theory, or restructuring of the field. Since a field theory proves elusive at this time (1973), a restructuring of the field by means of a modification of Auerswald ecological approach

will be attempted. The resulting theoretical and practical delivery systems will be tested under field conditions.

CHAPTER II

SYSTEMS IN CONTEXT: A Method

Structure and Ecology.

Ernst Haeckel (1867) defined ecology as: "The influence of the physical and biological environment on the behavior of organisms." A conceptual as well as operational continuity between environments can be achieved by making an assumption that this definition holds regardless of whether the environment happens to be a laboratory, a clinic, a city, an ocean or a jungle. Distinctions between ecosystems can then be made by reformulating the definition in terms of the structures of physical, biological and behavioral units together with the relationships between them.

One consequence of the assumption and the reformulation is that it makes it possible to do away with the term "natural" that is often a conceptual stumbling block in interdisciplinary discourse. Within a specified ecological context, all behavior of organisms is natural. The emphasis is thus shifted to relationships between variables and systems, with the problems and the disciplines utilized in solving the problems acting in combination to determine what is, or what is not relevant within a specific context.

If this structural formulation is combined with Duhl's definition of disease and formulation of disease etiology,

the options for the selection of the components of an ecological delivery system in the area of mental health becomes possible. What is needed is a psychological system, the elements of which are relationships between the organism and its environment. These units must share a continuity with the units of biological and natural science which will be employed in conjunction with it. Contained in the complete delivery system (including the biological and natural science components) must be methods of evaluating, and altering the relationships the system is constructed to deal with.

The Laboratory and Clinic in Context.

The psychological laboratory is where the elusive curves of nature are induced to fit straight line equations, and where reflexes, associations or gestalts can be studied as units, at the leisure of the experimenter. Though the mobilisation of laboratory resources is critical for both the understanding and the manipulation of variables influencing the ecological net, few applied psychologists are well read, even in the theoretical areas directly affecting their practice. Many clinicians have replaced knowledge which could be gained from careful experiments and cater instead to insights gained from unstructured observations in hospitals, where the environments at least bear a little more resemblance to those that most city dwellers inhabit.

Laboratories, in their turn, have in increasing numbers concentrated their attention on problems that are more re-

lated to academic and social traditions than they are to curiosity about the relationships between organisms and their enviornments. Since simple problems yield sucess and large grants and failure leads to loss of status and funds, easy, traditional problems are encouraged and supported. The distance between the clinic and laboratory is thereby extended, so that the clinic then becomes the laboratory of the applied psychologist who has lost contact with the traditional laboratory. The laboratory then becomes the domain of psychologists who have lost their curiosity for larger environments. And both groups occasionally influence the ecological net by introducing an occasional "new test."

These conditions often lead to different types of theories, methods, and procedures, few of which can be applied within a larger context. In ecological projects where a psychologist is asked to give advice as to how a city should be renewed, how a hospital should be restructured, or what sho ld be included in educational programs, the answers from psychology are often rather vague. This is not surprising since these questions require knowledge of variables involving environments, communication, and administration which psychologists seldom subject to vigorous study under controlled conditions. This may be why psychological theory in the context of the larger problems becom s a rationalization, the clinic an excuse and the laboratory a partially subsidized building housing occupational therapy for the professionally handicapped.

Convergence and Continuity.

Though the positive influence of the differing traditions of theory, laboratory and clinic has sometimes functioned as series of checks and balances which have proved helpful in some ways to psychology's development, ecology must concentrate on similarity and continuity. This means that the gaps between the three phases must be bridged. Duhl's formulation in fact demands that this gap be bridged--at least partially--by a learning theory (or system). There is, however, no theory or system of learning that even approaches universal acceptance in the field of psychology.

But just as Estes etal (1954) and Marx (1970) give a reasonably accurate account of the divergence present in modern learning theory, Bergin & Garfield (1971) and Bachrach (1962) reveal that clinical and counseling psychology is far from being a unified system. Here the badly splintered analytical schools are being challenged by new socially oriented forms of group therapy and by increasing growth of behavioral systems and theories.

Despite all of the division in other branches, it would seem that at least "systems psychology" would be systematized, but it is not. In fact, there appears to be two major systems psychologies, and very little overlap in personnel or techniques. The most dominant (see DeGreene, 1970) is concerned with problems of organization, management, communications and the relationships between humans and technological systems. Whereas the organization-technology school is

dominated by psychologists interested in engineering, counseling, and perception, the second school(called general systems) is dominated primarily by psychiatrists and psychologists whose main interestsare in social, motivational and clinical problems (see Gray et al. 1969).

Add the breach between laboratory, theory and applied areas to this divergence between branches of psychology, and the necessity for systematization can be easily be demonstrated. Take for example the case of a clinician who is suddenly given the responsibility for organizing a "drug program" for a region containing about 3 million people. In addition to the research problems outlined by Duhl (see page 14), the problems of staffing, motivation, training programs, cost/effectiveness, conflict, communications, social structure, politics etc. are all thrust upon him simultaneously! If the clinician--who of course is an "expert" on addiction-- is sufficiently "discipline myopic" to think in terms of patients and clinics instead of systems, he may soon find himself buried under a host of unexpected problems which could range from anything between a nurses' strike to extreme social and/or political pressure. His problem obviously requires contributions from all of the divided areas of psychiatry and psychology, plus a number of others. In short, this is a multidisciplinary problem to which psychology could contribute answers. But which psychology or psychologies? How should the resources best be coordinated? And what has this to do with learning theory?

Though the answers to these questions are far from complete, Helmer (1964, 1966) has done experiments dealing with individuals and shaping convergence of expert consensus through feedback. This he accomplishes through a process which he calls successive approximations. An alternative to this method is the "think tank" approach where the participants are given a problem and acceptance of a solution is made contingent upon unanimous agreement.

The method advocated here is a process of successive formulations based upon structural and methodological convergence. The goals are the attainment of a high degree of continuity which will facilitate the use of psychology in the ecological context. The dominant system is an inductive learning system--The Experimental Analysis of Behavior.

Summary

A definition of ecology is extended to include man made environments as well as those which occur without human intervention. The resulting environmental continuum, together with Duhl's formulations and definitions are then used to determine the options available for the construction of a delivery system dealing with "mental health."

Since the discipline of psychology lacks, as a whole, the continuity necessary for an ecological approach, it has been concluded that there is a possibility of constructing a delivery system by means of successive formulations. The degree of unity between the theoretical, applied, and laboratory areas, might therefore be achieved by formulating

clinical, social, systems and biological interactions in terms of the Experimental Analysis of Behavior and evaluating the results of application of the system in terms of Contingencies of Reinforcement.

CHAPTER III

ANALYTICAL METHODS IN CONTEXT

Introduction

Most behavioral formulations of psycho-analytical theories have been reactions against, rather than extensions of, one of the most influential disciplines to be expounded in the 20th Century. See Bandura (1969), Rönnberg (1969), Ullman & Krasner (1969), Wolpe (1969) and Yates (1970). In attempting to sweep away, with a single broad stroke, what they consider to be the remanents of a once powerful conceptual empire, the critics of analytical theories often overlook or distort by exaggerations much of the valuable knowledge and subtile observations collected in over half a century of concentrated clinical experience. Several clues as to direction, hints at formulations, and applied co-operation are therefore lost in the rationalized emotional arguments that follow as a consequence of this wasteful strategy. Paul Bergman offers a better alternative.

Instead of applying criticism from rival behavioral systems, Bergman (1960) performs a synthesis of analytical systems and a formulation of the results in terms of a learning-theory. The final product is a general theory of psychotherapy which skillfully uses the convergence within psychotherapy to effect a continuity between the clinic and the psychological laboratory. Bergman achieves this by using a simple learning-theory formulation to

organize the phenomena of psychopathology and psychotherapy around the concepts of exteroceptive stimulus, interoceptive stimulus, anxiety response, comfort response and defense response. Freud's final anxiety theory, Roger's hypothesis about therapist's empathy, concepts of physiological mechanism by Jacobson and Schultz et al, and finally the pavlovian formulations of Wolpe comprise the systems incorporated in the synthesis.

A General Theory of Psychotherapy

According to Bergman, two conditions had to be fulfilled by a general theory of psychotherapy (1) It should discriminate between the effective, neutral and harmful effects of any therapy and (2) it should put psychotherapy into a comprehensive framework of general psychology. He then presents three propositions concerning psychotherapy.

Bergman postulates two types of primary anxiety stimuli, a species specific stimuli and an anxiety stimulus that is specific for individual organisms. In this formulation, neutral stimuli can be associated with these primary stimuli whether the latter be exteroceptive or interoceptive. Organisms are said to have behavior which can be called "avoidance," "inhibition," "symptom or anxiety responses" that present a characteristic pattern termed the "pathological defense" of the organism. Physiological patterns which become attached to interactions between the anxiety defense behavior and their stimuli are said to give rise to interoceptive stimuli which in turn become attached to the behavior and achieve various degrees of autonomy. Still other physiological

patterns come to function as defenses against those interoceptive stimuli. This may result in the muscular tension or flaccidity, dysfunctional breathing, and lead to the type of behavior which affects the relationship between the organism and the environment.

Bergman labels as "crucial factors" the therapist's enthusiasm, faith, warmth, spontaneity, understanding, his evident commitment to the patient's way of experiencing interpersonal stimuli as positive or negative reinforcements. These are the factors which are said to "induce comfort responses."

From Rogers, Bergman has adopted the stress on therapeutic atmosphere as the counter conditioner and environment for change. An accurate symbolization of organismic experience is another Rogerian contribution to the Bergman formulation.

Desensitization procedures (see Wolpe 1968), physiological techniques for altering physiological patterns that accompany the provoking stimuli, and the removal of any and all behavior that prevents the organism from encountering the anxiety stimuli which is to be "counter-conditioned" form the crux of the recommended therapeutic procedures in the Bergman theory.

Bergman's conclusions favored the further development of empirical techniques for the control of interoceptive stimuli. Learning theory would then encompass the variety of elements needed for a theory of psychotherapy within the context of psychopathology. Purely verbal interchange would gradually give way to physiological techniques in the

area of preventive mental hygiene and self therapy. He was concerned, however, about what he termed the "most typical expressions of learning theory." These, he felt, did not focus upon "specific human qualities."

Conclusions.

Bergman's theory and formulations contribute to behavioral systems in a number of interesting and useful ways:

1) Instead of being an attack from without, it is a development from within the analytical school. As such, it maintains a continuity and set of priorities that are unique to the interpersonal clinical environment.

2) His formulation does not pretend to be a movement along new dimensions, but professes instead the strategy of further development along existing dimensions.

3) The consequence of this approach is that it is possible to effect a convergence of several of the existing clinical schools by use of the learning formulation.

4) By choosing this particular array of systems as the basis for his formulation, he in effect combines the disciplines of clinical psychology, physiology and behavioral psychology. This opens the clinical environment to a laboratory support from the two other areas.

5) The theoretical result of the addition of the two biologically oriented sciences is that the final theory is empirically testable and the results can be expressed in the physical dimensions employed in biological and natural sciences.

Despite a systems advantage over the individual theories that comprise it, the Bergman formulation does not cover a sufficiently large portion of the ecological net be used as the central learning system demanded by the Duhl formulation. There is also a serious lack of concrete units

(see page 5) for some of the important factors and variables. The method, however, is worth adopting, as are the variables and factors which the Bergman theory employs. In addition to effecting an interesting convergence, and establishing continuity between several areas, the theory indicates that it is possible to apply an S-R theory as a synthesizing formulation in a clinical systems context. This possibility has been vehemently denied by von Bertalanffy (1967) (1968), who advocates the adoption of a type of field theory instead.

Summary

Motivated by his concern with the huge gap between experimental and clinical psychologies, Paul Bergman combined Freud's final anxiety theory, Roger's hypothesis about therapist's empathy and the Jacobson, Schultz et al. concept of physiological mechanism into a general theory of psychotherapy. By formulating his theory within the framework of learning models, with Shoben and Wolpe serving as primary systems, Bergman effected a synthesis of several critical areas.

Though the Bergman method and variables will be adopted, the theory lacks both the range and the units to, by itself, cover the area of the ecological net demanded by the Duhl formulation.

CHAPTER IV

SKINNER IN CONTEXT: A Behavioral System & Theory

The requirements that a learning theory (or system) must meet to be included in the proposed delivery system have at this point been pretty much determined by the previous acceptance of the Miller formulation of systems, the Auerswald formulation of an ecological approach, the Duhl definition and formulation of the area of mental health, the Bergman method of effecting convergence by use of learning formulation, and the pragmatic goals of my formal theoretical approach.

The Miller formulation (see pg. 4) requires that: 1) concrete systems be given priority over abstracted and conceptual systems in the formulation. 2) That units and subsystems be carefully specified. 3) that a clear distinction between structure and process be maintained at all times. and 4) that ample consideration be given to relationships between different parts of the system, but always in reference to the whole.

The Auerswald formulation (see pg 2) requires that in addition to being multidisciplinary in scope, the delivery system must be: 1) behaviorally oriented. 2) structured by means of an ecological approach. 3) capable of being empirically tested, evaluated and improved. 4) capable of being applied directly.

The Duhl formulation (see pg 12) demands that the central system be: 1) capable of dealing with learning phenomena. 2) compatible with other disciplines active in the ecological net. 3) capable of dealing with problems of community and social evaluation. 4) free of severe language faults that handicap most of social science. and 5) humanistically oriented.

The Bergman (pg 28) formulation shares Duhl's humanistic and learning theory orientation, but requires in addition: 1) the system combine the laboratory and clinical areas of psychology and physiological approaches. 2) deal specifically with individual problems. 3) take into consideration those environmental variables that lead to comfort and warm interpersonal contact.

The formal pragmatic approach requires that the ecologist develope his system in such a way as to minimize intuition (unanalyzed prejudice) in practical situations. This implies the reduction of the gaps between theory and practice, with the specific problem acting as the common goal for both. In short, the resulting ecological delivery system must be capable of being expressed formally and applied pragmatically!

The system and the field

Since no comparisons between learning theories will be attempted here, the morphological aspects common to learning theories will not be reviewed (see Estes et al.(1954), Marx,(1970)). But there are several structural aspects

which were decisive factors in determining the eventual choice of the Skinnerian systems, over one of several field theories. Both field theories and the behavioral learning theories claim to have escaped from "animistic" views of causation. The conclusions of Estes (1954), however, suggested that the Skinnerian system might be the optimal choice in this context:

> Among field theorists Lewin has been an outspoken critic of animistic views of causation and yet has not been able to resist the temptation to assign to his theoretical concepts attributes of direction, attraction, repulsion, etc., thus remaining effectively in bondage to the mechanical models of classical physics. It seems to be not the field theories but more sophisticated S-R theories, notably that of Skinner, which are beginning to achieve freedom from the animistic theories implicit in everyday language and to reflect the methodological developments of physical theory. (pg. 320)

Subsequent studies have shown that the evidence supporting both Este's conclusion, and the use of Skinner's systems as the psychological base of an ecological approach is rather convincing.

Ecology and the Reflex.

If the relationship between psychology and ecology is to be developed into something more than another strained analogy, both the units and the level of complexity must be established. H.G. Andrewartha (1961) following in the tradition of Elton's (1927) Animal Ecology recognized three levels of complexity in the laws of ecology:

> Firstly, there are the laws governing the physiology and behaviour of individuals in relation to their environments; secondly, there are the laws governing the numbers of animals in relation to the areas that they inhapit; and thirdly, there are the laws governing communities. A

community may be thought of as an interacting population of plants and animals. The laws governing communities explain the interlocking network of niches which tie the different species together as a community.

Psychological laws are, in this context, first level formulations which must in some way establish an association between the environment, physiology and behavior. The operant systems accomplish this by extending the concepts of the reflex that were originally formulated by Sherrington (1906) and Pavlov (1927).

Skinner's Behavioral System

Though Kornorski and Miller's (1928) distinction between two types of reflexes preceded Skinner's (1935) by seven years, the invention of the controlled environmental space (the Skinner box) by the latter introduced a new methodology which was to prove essential in the extension of the reflex concept into the areas of learning and social psychology. A controversy between the original discoverers who were physiologists and the psychologist who had independently made the same discovery lead to some modifications and clarification of the distinction:

> There is, first, the kind of response which is made to specific stimulation, where the correlation between response and stimulus is a reflex as a respondent and use the term also as an adjective in referring to the behavior as a whole. But there is also a kind of response which occurs spontaneously in the absence of any stimulation with which it may be specifically correlated... It is the nature of this kind of behavior that it should occur without an eliciting stimulus, although discriminative stimuli are practically inevitable after conditioning. It is not necessary to assume specific indentifiable units prior to conditioning, but through conditioning they may be set up. I shall call such a unit an operant and the behavior in general operant behavior. (Skinner 1937)

The importance of the distinction becomes apparent when

empirical laws governing the two types of reflexes are subjected to examination. Skinner (1938) divides the respondent laws (Type S) into "static laws of reflex" and "dynamic laws of reflex strength." The operant laws are classified under "other dynamic laws," and the resulting behavioral system includes:

THE STATIC LAWS OF REFLEX

The Law of Threshold. The intensity of the stimulus must reach or exceed a certain critical value (called the threshold in order to elicit a response.

The Law of Latency. An interval of time (called the latency) elapses between the beginning of the stimulus and the beginning of the response.

The Law of the Magnitude of the Response. The magnitude of the response is a function of the intensity of the stimulus.

The Law of After-Discharge. The response may persist for some time after the cessation of the stimulus.

The Law of Temporal Summation. Prolongation of a stimulus or repetitive presentation within certain limiting rates has the same effect as increasing the intensity.

THE DYNAMIC LAWS OF REFLEX STRENGTH

The Law of the Refractory Phase. Immediately after elicitation the strength of some reflexes exists at a low, perhaps zero, value. It returns to its former state during subsequent inactivity.

The Law of Reflex Fatigue. The strength of a reflex declines during repeated elicitation and returns to its former value during subsequent inactivity.

The Law of Facilitation. The strength of a reflex may be increased through presentation of a second stimulus which does not itself elicit the response.

The Law of Inhibition. The strength of a reflex may be decreased through presentation of a second stimulus which has no other relation to the effector involved.

The Law of Conditioning of Type S. The approximately simultaneous presentation of two stimuli, one of which (the 'reinforcing' stimulus) belongs to a reflex existing at the moment at some strength, may produce an increase in the

strength of a third reflex composed of the response of the reinforcing reflex and the other stimulus.

The Law of Extinction of Type S. If the reflex strengthened through conditioning of Type S is elicited without presentation of the reinforcing stimulus, its strength decreases.

OTHER DYNAMIC LAWS

The Law of Conditioning of Type R. If the occurrence of an operant is followed by presentation of a reinforcing stimulus, the strength is increased.

The Law of Extinction of Type R. If the occurrence of an operant already strengthened through conditioning is not followed by the reinforcing stimulus, the strength is decreased.

According to Skinner (1937), an operant shows no "proper" latency (except to discriminative stimuli) no after discharge and most important of all, no ratio of the magnitudes of R and S. These differences plus unique properties of the operant reflex present formidable methodological problems in respect to both isolation and measurement of individual units. Since Skinner's solutions to these problems lead to formulations which are inductive in character, and therefore quite easily misinterpreted, a formal definition in the J.G. Miller systems tradition (though admittedly somewhat stilted) is necessary in the present ecological context.

Concrete systems of organisms and environments can, within the Skinnerian formulation, be expressed in physical terms, units and relationships. An organism is within this context a biological system with cells, organs, gross anatomical and chemical structures like all matter-energy systems. The environment, though distinguishable from the organism , is also expressed in physical units which commonly deal with matter-energy within a space-time frame reference.

After assuming come arbitrary co-ordinates of physical space-time, and accepting as valid the units of the physical and biological sciences, a response can then be defined as a change in an organism's physical units in relationship to some concrete frame of reference. Though each response is a unique event in physical time, and as such, never occurs again, it is possible to classify responses according to specific properties. Skinner used these response classes and not individual responses in defining operant reflexes.

When it can be experimentally demonstrated by control of relevant variables that a class of responses bears a consistant relationship to a class of environmental conditions following the response in time, then this relationship is an operant.

The conditions necessary to define an operant are in this sense operational in that control over the relationship is part of the definition. The operant thus defined is the unit of the Experimental Analysis of Behavior and the psychological unit of the delivery system to be employed in the applied portion of this work.

According to Skinner(1969) a natural datum in a science of behavior is the probability that a given bit of behavior will occur at a given time. The Experimental Analysis of Behavior deals with that probability in terms of frequency or rate (the spacing of events in time). Applying this measure to the above definition of the operant, it is possible to demonstrate that environmental events forming operant relationships with organisms have one of two consequences upon the probability of the occurence of the response: (1) it reinforces, increases the probability that

a response will occur, or (2) it has no effect. Reinforcers can then be divided into two classes according to the operations on the environment necessary to bring about an increase in the frequency of the response class. Those events that are added to the environment are called positive reinforcers and those that are removed from the environment are called negative reinforcers. It should be noted and emphasized that under both reinforcement conditions the response rate is increased.

Reinforcement and Programmed Environments.

By building artificial environments and using computers to program the relationships in time between reinforcement and response, experimenters have produced response rates and patterns that are so consistant as to merit the status of fundamental properties of behavior (see Morse and Kelleher, 1970). Under programmed reinforcement conditions the behavior of organisms in fact becomes so predictable that programmed behavior can be used as a means of assessing the effects of drugs, psychophysical relationships, learning, physiological variables and relative strengths of reinforcers. The elementary conditioning processes involved in these relationships (schedules of reinforcement) have been reviewed by Jenkins (1970) and stated as: a) reinforcement and extinction, B) stimulus discrimination resulting from reinforcement in the presence of one stimulus but enhanced by (possibly even established by) extinction in the presence of another stimulus, c) conditioned reinforcement resulting from the appearance of positive discriminative stimulus following a response,

and d) differentiation of response resulting from the differential reinforcement of responses having a certain property.

Within the context of the schedules of reinforcement behavior and environment are not taken as separate things or events, but interrelations among them (see Skinner 1969, pg 10). Experiments have proven that by programming the environment by use of reinforcers, both the topography and the stimuli associated with operant responses can be determined. Using the same procedures, experimenters have demonstrated that complex systems of behavior can be synthesized and controlled (see Findley, 1962 and Ferster & Skinner (1957)). A synthesis of these conceptual and experimental inter-reactions has lead to the term contingency which Ferster & Skinner(1957) defined as:

> Contingency (of reinforcement or punishment). (1) In operant conditioning: the temporal, intensive, and topographical conditions under which a response is followed by a positive or negative reinforcing stimulus or the removal of either of these. (2) In respondent conditioning: the conditions under which unconditioned and conditioned stimuli are paired.

A contingency is then (within the formal ecological context) the interrelations among a descriminative stimulus class, a response class, and a reinforcement class. All three terms must be specified.

It is apparent from the definition that the relationships making up a contingency are essentially of the same type as those comprising the simpler operant. In fact, it is justifiable to argue that a contingency is an operant in context, and as such, it is the unit of analysis and

synthesis in both the applied and theoretical aspects of the Experimental Analysis of Behavior. It is then the contingency that determines the level of analysis for the psychologist in an ecological delivery system.

The importance of the contingency and the method of specifying the three terms comprising it are sufficiently important to the applied section of this work to justify listing and specifying some of the more important contingencies. Skinner (1969) lists eighteen of the most common examples encountered in experimental operant research:

(1) Operant reinforcement. A hungry rat presses the lever and receives food. (frequency of pressing increases.) A pigeon pecks the disk and receives food. (Frequency of pecking increases.)

(2) Escape. The experimental space is brightly lighted. A rat presses the lever and reduces the intensity of the light. (The lever is then pressed more quickly when the light appears, or more often in sustained light.)

(3) Avoidance. A rat is shocked every twenty seconds except that a response to the lever postpones the next shock for twenty seconds. (Frequency of response increases and many shocks are avoided.)

(4) Stimulus discrimination. A rat presses the lever and obtains food when a light is on, but no food follows the response when the light is off. (Frequency of responding is higher in the presence of the light than in its absence--"S delta.")

(5) Response differentiation. Food appears only when the lever is depressed with a force above a given value. (Responses showing the required force appear more frequently.)

(6)"Superstition" The food dispenser operates every twenty seconds regardless of the behavior of the rat. (Any behavior occurring just before the appearance of the food is reinforced, and similar coincidences becomes more likely as the behavior is strengthened. The rat develops a "superstitious ritual.")

(7) Chained operants. Pecking a green disk changes the color to red, and pecking the red disk is followed by food. (The frequency of occurrence of the chain of responses increases.)

(8) Observation. A discrimination is set up under which a pigeon pecks a red disk but not a green. The color slowly fades, however, until a discrimination becomes impossible. Pecking another disk reverses the fading. (The pigeon pecks the other disk to produce enough color to make a discrimination.)

(9) Matching to sample. Three disks are arranged in a row. The middle disk to either red or green, the other two unlighted. A response to the middle disk lights the side disks, one red and one green. A response to the matching disk is reinforced with food. (Responses to the matching disk increase in frequency.)

(10)Delayed matching. As in (9) but the middle disk is darkened before the side keys are illuminated. (If the side keys are presented immediately, the pigeon is able to match. A short delay makes matching impossible. ("The pigeon cannot remember the color of the middle key.")

(11) Mediated delayed matching. There are five disks--one in the center and the others within easy reach at the four points of the compass. Center is either red or green. A response darkens it and projects white light on North and South. If Center was red, a response to North illuminates East and West, one red and one green. A response to the matching disk is reinforced. If Center was green, a response to South illuminates East and West, and a matching response is reinforced. Two chains are thus set up: (i) The pigeon pecks Center red, North white, and red on either East or West; (ii) The pigeon pecks Center green, South white, and green on East or West. The pigeon matches successfully because it responds to the red on East or West when it has just responded to South. Responding on North and South can then be protracted--for example, by requiring a number of responses to illuminate East and West. The number can be greatly increased. A long delayed matching response to East or West is mediated by the stimuli generated by responding North or South.

(12) Schedules of reinforcement. Reinforcements may be scheduled many ways. Each schedule, with given values of the parameters, generates a characteristic performance.

a. Fixed interval. A response is reinforced only when it occurs after the passage of a period of time (for example, five minutes). Another period begins immediately after reinforcement.

b. A fixed ratio. Every nth response is reinforced.

c. Variable interval or ratio. The interval or number in a. and b. need not be fixed but may vary over a given range around some average value.

d. Multiple schedules. One schedule is in force in the presence of one stimulus, a different schedule in the presence of another stimulus. For example, a fixed interval prevails when the key is red, and a variable

issue when the key is green. (A characteristic performance is obtained under each stimulus.)
e. Differential reinforcement of rate of responding. A response is reinforced only if it follows the preceding response after a specified interval of time (DRL) or before the end of a given interval (DHR). In DRL the interval might be, for example 3 minutes; in DRH, one half second.

(13) Multiple deprivation. Pecking one disk is reinforced by food, pecking another disk is reniforced by water, pecking a third disk is reinforced with either food or water at random. Under different conditions of hunger and thirst the rate of responding on the third disk is the average of the rates on the first two.

Some contingencies in the field of verbal behavior are as follows:

(14)"Mand." In the presence of a listener (S^D), the response Water is reinforced when the listener gives the speaker water.

(15) Echoic behavior. When someone says Water, the speaker says Water, and reinforcement is contingent on the similarity of the two sounds.

(16) Textual behavior. When looking at the printed word Water, the speaker is reinforced if he says Water.

(17) Intraverbal behavior. Upon hearing or reading the Water, the speaker is reinforced if he emits a thematically related response such as Ice or Faucet.

(18) "Tact." In the presence of a glass of water, a river, rain, and so on, the speaker is reinforced when he says Water.

The Experimenter, the Program and the Language.

In addition to being a fairly concise representation of some of the most commonly referred to contingencies in the area, the above quotations give a pretty good indication as to the direction that Skinner's behavioral system has taken in this theoretical and applied development.

Whereas the 1938 Skinner was preoccupied with extension of the reflex concept into more complex areas of

environmental-organism interaction, the 1969 Skinner has elaborated on the operant as a basic unit in the environmental context. The 1938 Skinner concentrated pretty heavily on the differences between the operant and the respondent, while the 1969 Skinner is dominated by the contingencies of reinforcement with its implications in both the laboratory and social contexts.

There is no mistaking the operant origin of Skinner's "verbal contingencies" and there is no mistaking the marked emphasis of the experimental approach in both the 1938 and 1969 formulations. But there are some characteristics of Skinner's system of behavior that often escape the casual reader. The most important of these is perhaps the way that the data is generated!

If one notes the complexity of contingencies (7), (9), (11) and (12)--especially the last two--it becomes rather apparent that an individual experimenter could never generate such conditions without the aid of a rather complex apparatus. In modern laboratories the experimenter translates his contingencies into the binary symbolic logic languages of the various computer and logic systems. The contingencies as well as the measurements are programmed.

This concept of experimenter as programmer places a heavy stress on the analyst's ability to describe precisely the behavior that he observes, and the conditions under which he observes it. He must--in addition--be capable of translating his descriptions into the symbolic language of

logical modules which will then control and measure (in terms of frequency and time) the behavior that results from the interaction between the programmed environment and the organism.

Under these conditions "The organism is always right!" (Findley 1962). If there is any fault to be found, it is in the programmed environment which is the independent variable with which the organism reacts--reacts according to the laws of the individual organism which the experimenter hopes to discover! Finding the faults in a program is called trouble shooting. And trouble shooting becomes necessary when the behavior of the organism does not function within certain defined limits that are determined by the experimenter.

This methodology has a strong effect upon the language. Behavior is often said to be "modified" or "controlled" rather than elicited. A description of the contingencies is sufficient explanation for predicting, modifying, controlling or classifying behavior. Since operants are inductive statistical concepts, a single response to an environmental event has meaning ONLY IN CONTEXT. And since the system does not accommodate hypotheses in the usual sense (see Murray Sidman 1960) a response out of context is simply a response out of context.

The Significance of A Single Operant.

That the goal of all of the defining, programming, measuring and trouble shooting is the isolation and study of a single operant like bar pressing, or key pecking strikes

some critics as being "too simple" or "rather odd." But the rationale as well as the perspective of this approach is expressed by Schoenfeld & Farmer (1970):

> We take as axiomatic that behavior is a continuous stream. As Skinner noted, the stream may be divided for analytic purposes into reflex units the actual sizes of which are determined by the lawfulness they exhibit.

The tacit assumption underlying operant research is of course the fact that individual reflexes show a considerable amount of similiarity. This assumption has up to this point (1973) proved reasonably valid since the patterns encountered in various contingencies of reinforcement have been proven to be constant over a variety of environments, species, reinforcements and behavior.

It is apparent now that individual operants are influenced by other operants (see Catania 1966) and consequently an emphasis on systems and context is as necessary within the operant frame of reference as it is in other ecological systems.

Schedules of Reinforcement.

Though some reviews of operant literature leave readers with the impression that Master Skinner has painted upon the canvas of psychology with great, broad, strokes; leaving the details(parametric studies) to underlings with refined, small hair brushes. This is hardly the case. It is true that Skinner's philosophy of science, methodology and language have earned him an impressive following. But Skinner has never occupied a position in operant conditioning comparable to that of Freud in the field of psychoanalysis. The present status of the Skinnerian influence is best

depicted by developments within the area of schedules of reinforcement.

Though the role of multiple causation in the schedules of reinforcement is obvious, and the original findings of Ferster & Skinner (1957) have been for the most part confirmed, some initial definitions are not holding up so well under the attack of new computer based technologies. Increasing use of mathematical definitions and languages offers a solution to some of the major problems (see Snapper et al 1970, Weiss, 1970). But relationships--especially those encounterred in FI Schedules--involve higher-order effects that are presenting problems, the solutions to which, may have far reaching consequences in every aspect of reinforcement contingencies. Since these issues--unfortunately--do not play a major role in the present context, and Schoenfeld (1970) gives a very excellent review of some of the more critical issues, a further discussion will not be included here. The importance of this area should, however, not be underestimated.

Summary

The acceptance of the formulations of Miller, Bergman, Duhl and Auerswald together with the pragmatic use to which the ecological delivery systems will be put reduced the number of possible central formulations to a choice between behavioral learning theories or systems. Estes conclusion based on structural considerations was stated, along with Andrewartha's formulation of ecological levels. It was then proven--by definition--that the operant is and eco-

logical unit.

Skinner's behavioral formulations of 1938 and 1969 were reviewed and compared, along with some of the problems which have arisen in connection with recent work with schedules of reinforcement.

CHAPTER V

MINI-SYSTEMS: A basis for Order and Application

The Experimental Analysis of Behavior has enjoyed a period when the majority of the names associated with leadership in the operant animal laboratories correlated very highly with the names of the leaders appearing in applied areas of human behavioral modification. Possibilities for positive transfer under these conditions approached optimal levels due to the fact that the principles and laws of behavior seem to apply over a broad range of species as well as environmental conditions. Even the language of the operant laboratory lends itself to translations into instructions (coded or uncoded) that are so simple that most laymen and some animals (see Thompson, Bigelow and Pickens, 1971) can affect behavior by introducing reinforcers into the environment on schedules which follow operant principles.

Both success and the deceptive simplicity of operant techniques have in recent years lead to their adoption by practitioners who share neither the theoretical background, programming experience nor the familiarity with some of the more practical aspects of conditioning so prevalent in the laboratory. A disregard for some of the important structural aspects and definitions of the behavioral system often accompanies such adoptions, so that a number of incon-

sistencies occur which resist all reasonable attempts to resolve them. To resort to hypothetical constructs is only to complicate the impossible so that the net result is a loss of continuity between theory and practice.

An alternative approach is to let mini-systems (which while preserving both the structural continuity and the laboratory effectiveness) act as ordering systems for operant principles until such time as a general system evolves. This can be accomplished by using an ecological approach to take advantage of the convergence and continuity of several mini-systems which can be integrated into a delivery system.

Schedules, Programs and Language.

The operational and conceptual unit of the operant laboratory is the contingency (see definition above) and the language is the language of the electronic circuits and logic modules that drive these contingencies, orders them, and gives them expression in programmed environments. The most important dimension expressed in the silent circuits, clicking magazines and flashing stimulus lights is time. And time is a bane to language, especially when it comes to expressing parallel events occuring in comp ex sequences which may follow any of many combinations of alternative routes.

Korzybski (1933) attempted to solve the time-language problem through use of a mathematically based reorganization of common prose, while Reichenbach (1947) showed the tenses of verbs of most western languages to be inadequate when compared to symbolic logic expression of events in time.

Visualization also becomes a problem (see Reichenbach 1958) when time and space dimensions must be considered within the same conceptual frame. And where precision is a factor, normal prose are shown to be clumsy and cumbersome if not totally inadequate.

Though several schemes have been offered: Mechner (1959) Skinner (1958), Findley (1962) and Schoenfeld, Cumming & Hearst (1956), the system which appears to combine the qualities of accuracy, maximum visualization, simplicity and interdisciplinary convergence is that of Snapper, Knapp & Kuschner (1970). In response to the difficulties encountered in descriptions of schedules of reinforcement, where confusion has lead to different measurements (see Dews, 1970) Snapper et al. have advocated the use of state diagrams. Based on a theory of finite automata (Mealy, 1955, Moore, 1956) the state diagram notation requires that schedules of reinforcement be treated as sequential systems. Schedules of reinforcement (see Figure 4 and Table 5) and several other contingencies have proven quite amenable to this treatment.

In addition to making programming language amenable to various mathematical and computer treatments, the acceptance of the state diagram notation effects a linguistic convergence with other branches of systems theory for example: Operations Research and Feedback Control Systems. Even Tharp & Wetzel's (1969) diagrams for contingencies encounterred outside of the laboratory environment can easily be accomodated by the Snapper et al. notation. Since instructions to laymen can usually be reduced to

simple everyday sentences, there is every indication that a behavioral ecology would sacrifice very little by adopting a mathematical language and symbol system that is free from many of the logical contradictions that occur in normal verbal systems.

Premack, Reinforcement and Punishment.

The extension of a statistically based mathematical formulation of reinforcement and punishment has lead both to a dimensional continuity and a linguistic bridge between the common sense notions of motivation and those of the operant laboratory. Previous to David Premack's (1965) formulation, punishment was defined operationally as either the application of a negative reinforcer or the withdrawal of a positive reinforcer, following a defined response. (See Holland & Skinner, 1961.) Positive reinforcement was adding a positive reinforcer to the environment after a defined response and negative reinforcement was withdrawing a negative reinforcer from the environment after a defined response. The Ferster & Skinner (1957) definitions define reinforcement and punishment more in terms of contingencies but there is no essential difference between the Holland & Skinner and the Ferster & Skinner definitions.

Although a convergence with common sense notions of reward and punishment was made relatively remote by this formulation, the operational reinforcement paradigm has been proven sufficient enough to generate efficient programs in token economy types of ward management of schizophrenic patients (Ayllon 1963), experimental analysis of

autistic children (Ferster, 1962) and reinforcement of imitation in children (Baer & Sherman, 1964). These clinical applications were, however, not of the complexity of the ecological problems that are of primary interest here. These demand both the higher degree of continuity and the greater convergence potential of the developed Premack Principle (Premack, 1971).

Premack begins with four assumptions: 1) Organisms order the discriminable events of their world on a scale of value. 2) the value that an organism assigns to a stimulus can be measured by the probability that the organism will respond to the stimuli. The probability can be estimated from the duration for which the organism responds. Durations can be compared over all stimulus and response dimensions under constraints which reduce to the requirements that either the rate-time functions for the several responses be comparable, or the probabilities compared be momentary rather than average. 3) Value is a unitary dimension. 4) Motivational phenomena-reinforcement, punishment, contrast, arousal-all result from a common state of affairs: a difference in value.

The empirical evidence supporting these assumptions imply a linear relationship that becomes <u>reinforcement</u> when a more probable event is made contingent upon a less probable event, and <u>punishment</u> when a less probable event is made contingent upon a more probable one.

While accounting for the relativity of the reinforcement relationship, the Premack formulation offers a broader,

more general concept which will be used to advantage in the two studies below.

The Behavioral Stream.

Just as some system was needed to organize reinforcement along a useful dimension and effect a convergence between laboratory and larger ecological environments, a synthesis of laboratory concepts of the behavioral stream and the time dimension is demanded for work in the greater ecological context. A combination of Schoenfeld and Farmer's (1970) formulation, and the concept of concurrent operants as formulated by Skinner & Ferster /1957) and developed by Catania (1966) offers a partial solution to the problem.

The "behavioral stream" concept has been a part of the experimental analysis of behavior since Skinner's (1938) formulation of his behavioral system. It asserts that behavior, in context, is not a single class of operants but a stream of responses which bear different relationships between themselves and the environment in which they occur. A programmed environment is constructed to select, isolate, control or often synthesize a portion of this stream so that the portion might be measured and studied by experimenters. Schoenfeld& Farmer(1970) question whether the behavior defined as response within the programmed context might not be influenced by behavior that is not defined as a response.

According to the continuity hypothesis if the experimenter arbitrarily defines part of the behavior as a response (R), all other behavior automatically becomes a member of the class non-response (R̸). Non-response (R̸) classes must

necessarily have temporal relationships with response classes (R) and reinforcement classes (S^R). The question then arises as to the relationships (effects) that the class ($\not R$) has to (upon) class (R).

Taking full advantage of continuity and the complimentary relationships between (R) and ($\not R$), Schoenfled and Farmer specify a response in terms of the duration of the period in which non-responses ($\not R$) occur. Acceptance of these definitions has rather profound implications regarding the relationships comprising "contingencies."

A contingency in this context becomes: "that the distribution in time of R determines the distribution in time of reinforcements" and <u>non-contingency</u> means: " that the temporal distribution of reinforcements is not determined by the temporal distribution of responses."(Schoenfeld, 1970, pg 221)

Schoenfeld and Cumming (1956)(1957)(1960) have demonstrated that by controlling the distribution and density of reinforcers in time, an experimenter can generate all of the known schedules of reinforcement, plus several that have not as yet been investigated. This supports the Schoenfeld-Farmer formulation in principle. But Travis Thompson (in a series of private conversations) has raised the issue of the effect of intruded stimulus upon interpretation of theories of FI schedules in this connection. Since there is a difference in the definitions of FI schedules, the Dews experiments (1970) may not effect the interpretation of the Farmer & Schoenfeld experiments (1966) as Thompson suggest. The possibility does exist, however.

Concurrent Operants.

Related to, but not indentical to, the behavioral stream is an interaction between two or more operants called concurrent operants which Ferster & Skinner (1957) defined as:

> Two or more responses, of different topography at least with respect to locus, capable of being executed with little mutual interference at the time of rapid alternation, under control of separate programming devices.

Since,in the case of concurrent operants, changes in the consequences (such as frequency of reinforcement) of one operant affect the rate of other operants, concurrent operants behave differently together from the way in which each operant behaves in isolation. (See Catania, 1966). This is true dispite the fact that changes in the rate of one operant does not have a direct effect upon the rates of other operants. Compatibility may play a role in this relationship.

If topographical compatibility is defined in terms of the possibility of two operants occuring at the same time as well as in succession, compatibility would appear to be a necessary condition for maximal independence. This would imply (according to the laws of reinforcement) that the accidental correlation of an operant with reinforcement programmed for a second operant as well as its own independent reinforcement might lead to concurrent superstition (see Catania & Gutts, 1963.) In this case, dependence becomes a consequence of compatibility!

The conclusions that can be drawn from Catania's experiments are:

1) It may be necessary to program schedules in such a way as to make concurrent operants in fact independent with respect to schedules of reinforcement. This can be of consequence in study, control or manipulation of operants.

2) When similar reinforcers are programmed for each of two concurrent operants, increases in the rate of reinforcement for one operant produce decreases in the rate of the other operant.

3) When one of the operants is punished, increases in the rate of punishment of that operant produce increases in the rate of the other operant.

4) When reinforcement is programmed for one operant while a concurrent operant avoids an an aversive stimulus, the aversive stimulus or other stimuli with which it is paired may produce decreases in the rate of the first operant.

5) Concurrent operants may be conceived as reciprocally inhibitory systems in which the reinforcement of one system produce decrements in the rates of the other. In addition to affecting a convergence by analogy with physiological systems, the implied polarity of punishment and reinforcement lends some support to Premack's formulations above.

6) And finally, by supporting the concept that a given rate of reinforcement tends to maintain a constant total output over time that is independent of the local temporal constraints of this output, does imply that perhaps if the non-response (R) class of the Schoenfeld-Farmer formulation was analyzed for concurrent operant relations, and the Dews FI definition was tested with the (R) - (R) context, the result might resolve the dilemma in this area.

The combination of the behavioral stream and concurrent operant concepts gives schedules of reinforcement a complexity that is sufficient to account for acquisition, extinction and maintenance of behavior over a limited range. But the formulation at this point does not approach the complexity necessary for use in the ecological net. For this, an extension of the schedules and contingency concept to "higher-order" combinations is mandatory.

In addition to showing a consistancy of rate and pattern that permits them to be used as orderly dependent variables, programmed schedules of reinforcement have revealed some interesting properties of complex behavior. Not the least of these are the roles of reinforcement in chains of responses.

According to Kelleher (1966), a chain of responses (or response chain) is a response sequence in which each response either functions as a discriminative (or eliciting) stimulus or produces a discriminative (or eliciting) stimulus controlling the response that follows. The key to maintainance of such long chains seems to depend upon establishing a stimulus as a conditioned reinforcer. Studies have shown (see Jenkins, 1950 and Bersh, 1951) that an effective procedure for doing this is by repeated pairing of a stimulus and a primary reinforcer, with the stimulus briefly (0.5 to 1 sec.) preceding the primary reinforcer. The stimulus need not, it seems, be a discriminative stimulus.

Once established, a schedule of reinforcement can be treated as a unitary response. It can be reinforced according to some schedule of reinforcement so that the result is a chain of chains known as a second-order schedule. Findley (1962) begins by defining schedule sequences as chains and choices between schedules as options. Combinations of chains of schedules and options are trees and combinations of trees are then designated as groves. This complex class of behavior is referred to as multi-operant repertoires, the order of which has been further extended by Bigelow and Thompson (1968).

A third-order schedule is a complex schedule of reinforcement where two schedules are followed by stimuli and only the third and final schedule is followed by a primary reinforcer. In third-order fixed ratio schedules, Bigelow and Thompson found that brief stimulus presentations can be used to control the pattern of performance. Interactions between the schedules in third-order programms suggested that these schedules may have properties not readily predictable from second-order schedules.

The addition of higher-order schedules to existing methods of generating and studying units from the behavioral stream extends the reflex into areas where it can begin to deal with relatively complex structures of the order of mathematics (Ferster, Clifford & Hammer, 1955), psychopharmacology (Thompson & Schuster, 1968), programmed environments for study of human behavior (Findley, 1966), study and production of altered physiological states (Brady, 1966), comparative psychophysics (Sperling, Sidley, Dockens & Jolliffe,1968), child behavior and development (Bijou & Baer, 1966), modification of psychotic behavior (Ayllon, 1963), programmed learning (Skinner 1968) space technology (Rohles, 1966) and behavioral modification in natural environments (Tharp & Wetzel, 1969).

Since any operant principle discovered in one area has a high probability of being valid throughout the field, few researchers are hindered by traditional boundaries between different areas of psychology or even between disciplines. This general applicability accounts for the fact

that the same researchers in this field make contributions over a wide range of disciplines and areas. The positive transfer is indicative of a continuity both in principles and procedures. A. Charles Catania (1971) has made an attempt to formulate a synthesis of these procedures within a single conceptual framework.

Catania's Procedural Space.

Though a considerable amount of evidence points to the achievement of a general continuity within the area of operant conditioning, this still does not completely answer the question as to whether a peripheralistic, probabilistic approach can be used to analyze and synthesize extensive ecological and psychological relationships--without resorting to hypothetical constructs and/or postulated entities. (See Danahoe, 1971.) Even the concept of the reflex is still a point of contention.

The fact that neither Kornorski and Miller (1937) nor Skinner (1961) have succeeded in reducing the other's reflex unit to a status of subset of a "preferred" or more basic class is an interesting aspect of the integration-continuity problems in the field which must be at least partially solved before a formalization of integrated behavioral approaches is possible. Attempts at dividing the field with the concepts of autonomic and somatic physiological components simply extended the conflict to a dead end. An interesting node in the autonomic-somatic controversy developed when the combined studies of Miller and Carmona (1967),Konorski (Wyrwicka, 1967) and Brown & Jenkins (1968) indicated that the autonomic responses can

be controlled by operant procedures and somatic responses can be controlled by respondent procedures.

Catania (1971) resolves the conflict (at least for purposes of application) by imposing a procedural space upon four different pairings of stimulus (S) response and (R) relationships. Catania's procedural space is concerned with two types of events: (1) environmental events called stimuli and (2) organismic (behavioral) events called responses. He defines these events in terms of experimental operations and measurements which are performed on a stream of transitional states. Catania concerns himself with the specification of probabilities of transitions among events in the stream.

Given the concepts Stimulus (S) and Response (R); four different pairings exhaust the logical possibilities R-R, S-R, R-S and S-S. The procedural analysis is carried out in terms of these paired relationships so that R-R is used to classify response units and determine their hierarchiacal properties; S-R units are means by which stimuli can be manipulated and be avior can be therefore controlled by the environment, R-S units are used to show how behavior can be controlled by its consequences and S-S units represent experimental operations and properties of the environment.

A reference frame (see Fig. 3) is constructed for these units. It has three dimensions: 1) the elicitation dimension, a stimulus dimension divided into aversive, neutral and appetitive sections. 2) An R-S dimension showing the effects of responses on the environment. This dimension is divided

into three secotions according to whether a response increases the probability or reduces the probability of stimulus occurance, and 3) An S:R (discriminative control) dimension which shows the relationship between a discriminative stimulus, S:D, and an R:S relationship. By superimposing the second two dimensions on the first, Catania creates a three dimensional operational space which can serve as a classification system that emphasizes continuities, similarities and interrelationships among the procedures (see Donahoe, 1971).

In addition to serving as a rather exhaustive data and operational space, Catania's system has a dimensional property that gives it several advantages over typological classification systems, especially when scaling and measurement are desirable (see Ekman,1951). The result is a set of continua that reduce such controversies as the Miller-Kornorski, Skinner argument on the distinction between Pavlovian and operant reflexes and the Skinner (1957) Chomskey (1964) debate over verbal behavior to mild misunderstandings about points on an operational continum. Important mini-systems such as those of Schoenfeld et al. (1956), Sidman (1953) and Premack (1971) are also easily accommodated. And quite germane to our discussion here is the fact that many ethological relations can also be included as well.

Within the Catania Space behavior is described and defined according to procedures which control it. This implies that given a description of a procedure and the

control over the necessary variables, control over behavior follows as a consequence. The procedural space is therefore the modification space!

The consequences of modification, of course, can only be determined empirically. What is needed is therefore a consequence space, which for the sake of modification should correspond as closely as possible to the operational space. Perhaps some modification of the Catania space can be used since it is possible to accommodate the majority of the most important mini-systems within this space. But as of now, a consequence space does not exist.

Summary

By emphasizing rate, the spacing of events in time, as the fundamental measure, and accepting the reflex as a fundamental unit, then depending upon an inductively based correlation procedure for defining relationships between events, the Experimental Analysis of Behavior is becoming increasingly dependent upon computer technology for describing both the methods and the results. This trend, which began with the combination of operants into schedules of reinforcement, has lead to a parallel development of the system, the technology and the language. Now, simple schedules of reinforcement are beginning to give way to complex, mixed, multi-operant schedules and the cummulative record (a simple mechanical graph which records responses on the y-axis and time on the x-axis) has started to give way to three dimensional computer plots. These developments plus the time variable and parallel events have combined to stress the prose of normal language to the breaking point.

The use of mini-systems has helped to simplify matters by organizing some difficult relationships along continua, but most of these systems are, like the analysis itself, probabilisitic. The net result has been a progressive development within the Experimental Analysis of Behavior toward more mathematical language and concepts.

The Snapper etal. mathematical formulation of schedules of reinforcement is therefore an expression of a logical and necessary step in the progress of the behavioral system. The state diagram maintains the visual clarity of the cummulative record, while offering the logic and internal consistancy of a developed mathematical system. This in turn facilitates the integration of operant systems with other systems present in the ecological net.

Premack's mini-system places the motivational concepts of positive and negative reinforcement, together with punishment along a single liniar continuum. It also describes, and therefore explains, the dynamic fluctuations which occur within the operant context. In addition to functioning as an ordering system within the field, it serves as a link between the"common sense" notions of reinforcement, and the laboratory systems.

If Premack's system of motivation is combined with the concept of the behavioral stream, the relationships between reinforcement schedules and on going operants extends reflex complexes into the area of total behavior. The addition of concurrent operants and their relations to the other two systems broadens the ecological field to a point

where it is applicable to simple environments outside of the laboratory. Finally, the higher-order conditioning concept extends the previous systems' power to include interactions between multiples of reinforcement systems and gives the behavioral system the complexity needed to deal with relationships between "higher" organisms and complex environments.

The result of augmenting the main Skinnerian system with combinations of these mini-systems is a complex of procedural and conceptual continua which Catania orders within the context of a procedural space. The consequence of this space is to permit an ordering of procedures, which in turn produces a continuity in some areas where conceptual disputes existed. An inherent structural continuity accounts to a great degree for the general applicability of the system in several multidisciplinary contexts.

CHAPTER VI

CAMEO & INTAGLIO

A system is a constantly changing cameo and its environment is a similarly changing intaglio, and the two at all times fit each other. (James G. Miller)

The Experimental Analysis of Behavior has demonstrated through application of its operant technology that a controlling relationship exists between the environment and the organism. This relationship appears to be reciprocal, and balanced in a type of dynamic equalibrium. The not so tacit assumption underlying the Experimental Analysis is that the environment plays the dominant role in the relationship, and that even though the behavior of organisms may vary over a broad range, the contingencies at a given moment determine both the type of behavior and its pattern in time.

Since these contingencies and relationships are best described within the context of systems and processes, portions of Miller's general systems formulation of group organization will be reviewed. This review will be followed by Ayllon and Michael's use of token schedules, Tharp & Wetzel's community based application of "contingency management", Birdwhistell's Kinesics, and finally Sommer's formulations of spacial relationships of small groups.

LEVEL

Various disciplines have divided the known universe

into a hierarchy of systems, each higher level of systems being composed of systems of lower levels. Beginning with particles, an ascending order of these levels might read: particles, atoms, molecules, polymers, organelles, cells, tissues, organs, organ systems, organisms, groups of organisms, organizations, societies, nations ...etc. Miller (1971) selects one of these levels and arbitrarily designates it system while those levels below are called subsystems and subsubsystems. Above the level of the reference system, the terms suprasystem and suprasuprasystems are employed.

Miller establishes a formal identity among concrete systems by means of a three step procedure which includes the recognition of comparable aspects of two or more systems and proving the hypothesis of a quantitative relationship which is comparable in the respective contexts. It is asserted that the result of combining units into systems leads to properties that are unique for the resulting system, and that these properties, called emergents, are often difficult to describe in terms of lower level dimensions.

Critical Processes and Subsystems

There are certain processes that are necessary for the survival of the organism. These critical processes are carried out by eighteen critical subsystems which Miller classifies according to whether they process matter-energy, information, or both. The variables considered most important for describing such subsystems usually include : sorts processed, total processed, place processed, changes

in processing activity over time, changes in processing under different circumstances, rate of processing, costs of processing, and rate of change in processing. The numbers of units (components or members) engaged in the process can also be quite significant.

Information in this context is defined as:"the degrees of freedom that exist in a given situation to choose among signals, symbols, messages, or patterns to be transmitted." Meaning is the change in a system's processes elicited by information. Meaning becomes an important variable for information processing systems.

An ingestor is the subsystem which brings matter-energy across the next subsystem the boundary, which functions as a cohesive, protective, and selective system for both matter-energy and information. The distributor than carries the inputs (and often outputs) to various subsystems, one of which canges inputs into utilizable forms. This is called a converter. Matter-energy inputs to the system or outputs from the converter are formed into materials for: growth, replacement, repair, information markers for the suprasystem or outputs of products by the producer subsystem. A matter-energy storage subsystem deposits the matter-energy to be retained in the system, and the extruder subsystem removes products and wastes. The system, or parts of it are moved--in relationship to its environment-- by a motor subsystem and spatial relationships among the components are maintained by supporter subsystems.

In addition to the critical matter-energy processing subsystems described above, there are also critical infor-

mation processing subsystems.

An input transducer is a sensory subsystem that brings markers across the boundary. Once in the system, information may be alterred by (a) an internal transducer subsystem which takes all information from and about all subsystems and components and changes it to matter-energy forms suitable for internal transmission. (b) a decoder subsystem which translates the input information into the systems own "private" code. A channel and net subsystem composed of one or more routes in physical space form connections for transmitting markers to all parts of the system. Learning is carried out by two subsystems. First an associator, subsystem forms enduring associations among items of information. These associations are stored by the memory subsystem for some period of time. The decider subsystem receives information inputs from all subsystems and transmits to them information outputs that control the entire system. Heirarchical (sic) arrangements of levels of deciders are called echelons. An encoder subsystem changes the system's "private code" to codes that can be interpreted by other systems and the output transducer puts out markers bearing information from the system which can then be transmitted through environmental channels. The creation of new systems is the function of the reproducer subsystem.

Steady State, Stress and Feedback.

Miller defines equilibrium as a condition of a system when opposing variables are in balance. Altering fluxes of matter-energy are characteristic of living systems. This dynamic (continually changing) type of equilibrium

is called a steady state which may assume one of three forms: 1) It may undergo changes which have no cummulative effects--neutral. 2) Changes may be counteracted by subsystems, yielding a stable form. or 3) Slight changes may lead to a loss of equilibrium which means that the system is unstable.

Living systems maintain an equilibrium both within the system and with the environment, an equilibrium which has a characteristic range of stability. Any combination of excess or lack of input or output that forces the system outside of its range of stability constitutes a stress, which in turn produces a strain. The totality of strains is the value of a system and priorities assigned to reduction of specific strains is the hierarchy of values of a system.

Feedback is a fundamental process which is important for the maintainance of steady states. As Di Stefano III, Stubberud & Williams (1967) define it:

> Feedback is that property of a closed-loop system which permits the output (or some other controlled variable of the system) to be compared with the input to the system (or an input to some other internally situated component or subsystem) so that the appropriate control action may be formed as some function of the output and input.

Feedback can be divided into classes depending upon the relationship between the output and the steady state. Positive feedback increases the deviation from the steady state, while negative feedback decreases it. Feedback and many of the other processes may be aided or hindered by inclusions (part of the environment which is contained within the boundary of the system) or by artifacts which are inclusions produced by the organism.

Groups as Systems.

The massive number of reviews of experimental literature

and definitions in Miller's general systems formulations are directed toward one purpose, the formulation of analysis of groups in terms of concrete systems. As might be expected, the role of communication nets and feedback systems grow in proportion to the increasing complexity of the systems at higher and higher levels of analysis. Organization of the nets is an important variable in group survival as is feedback, physical space, stresses, overloads, equilibria and the continual changing of roles by group members.

External rewards coming from the achievement of group purpose and internal rewards that come from association and interaction between members is expressed as rewards-costs relationships which are deemed important. The nature of these rewards are related to the critical process, but the mechanisms of the association are not specified in Miller's system.

What emerges from the Miller studies is the fact that research and theory concerning group processes are essentially in the same disorganized state as other branches of psychology. The ratio of theory to experiment is high and scattered among investigators that range from clinicians to computer simulators. The gap between the laboratory and the field is wide and there is a heavy reliance upon abstracted rather than concrete systems. Miller's formulation in terms of general systems theory is therefore an attempt at taking advantage of continuity to establish order.

Token Schedules of Reinforcement.

The token schedules of reinforcement belong to the

class of chain schedules which are responsible for the establishment of operant techniques in the broader social context. Roger Kelleher (1966) lists three properties of these schedules: 1) the stimulus changes are related to primary reinforcers. 2) a brief stimulus change occurs at the completion of each component of the schedule, and 3) the gradual accumulation of tokens function as a constantly changing stimulus. The patterns and effects of these schedules were the same whether chimpanzees or pigeons or children were used as subjects. (See Wolfe, 1936, Cowels,, 1937, Kelleher, 1957, Zimmerman & Ferster, 1964, Ferster & DeMyer (1962).

Regardless of species, the method of programming behavioral schedules is essentially the same. But certain classes of behaviors do not lend themselves to programming by means of present day laboratory equipment. And since operant techniques require that responses be clearly defined and reinforcement applied within precisely defined intervals, a new technique had to be discovered before these problem behaviors could be studied with operant procedures.

A solution to this problem was discovered by Ayllon & Michael (1959) who after testing reinforcement techniques on psychotic patients in a mental hospital(see Ayllon, 1963) employed psychiatric nurses to observe, record, reinforce and extinguish behaviors. This solution was significant in that 1) it permitted a later refinement by Ayllon & Azrin (1968) which lead to the establishment of a "token economy" where the behaviors of groups of patients were maintained by means of a single token schedule, and 2) It proved that

personnel who were not trained in psychology could master the application of basic techniques of observation, recording and reinforcement principles in a relatively short time. Thompson & Grabowski (1972) later proved that personnel with no previous professional training could sufficiently master the basic techniques so that they could teach basic behavioral repertoires to severely retarded mental patients by means of token schedules and the principles of reinforcement.

The application of operant techniques and behavioral observations by laymen completed the convergence of the roles of behavioral analysts in the laboratory and clinic. The emphasis in both places is on rearrangement of environmental rewards and punishments which strengthen or weaken specified behaviors--or in other words, contingency management. However, an important difference occurs when reinforcement is dispensed by people without the benifit of computers, logic systems and electronic recording devices. Problems of administration, social structure and communication become paramount if the program is to be properly implemented. The trouble shooting tasks often include resolutions of conflicts over territory, status, time and all the issues dealt with by operations research, organization psychology, group analysis and social psychology.

Community Based Programs.

These social and organizational problems come into sharp relief when the methods of contingency management are applied in what Tharp & Wetzel (1969) term "natural environments." When social factors generate the events which affect human

behavior, the problem then becomes one of specifying roles which individuals in the environment of the "patient" may play so as to modify the behavior. Tharp & Wetzel use an extensive behavioral and contingency analysis coupled with an organizational pattern called the consultative triad to construct the programs necessary for behavioral modification within the patients' normal social environment.

In addition to being faced with large complexes of behavior, Tharp & Wetzel also had to deal with problems of reciprocal reinforcement. This was true of clinical studies of token reinforcement that were cited above, but instead of working with personnel associated with an institution, natural environment modification demands working out a program where totally untrained observers with relationships ranging from close relatives and wives to teachers and employers must be taught to make the observations and carry out the procedures according to the contingency program. This entails a careful contingency analysis of the environment, institutions, groups and everybody involved--including the analyst.

In the triadic model (see Fig. 5) the designer of the contingency program is called the consultant. the consultant need not have any direct interaction with the patient or target of the behavioral intervention. He functions through individuals who bare some normal role relationship to the target. The person actually controlling the reinforcement is the mediator. Selection of a mediator to act as the intermediary of the consultant is based upon two criteria:

1) possession of the target's reinforcers, and 2) the capacity to place them on contingency. It should be noted here that all of the roles are defined functionally. The triadic model is therefore a structural model which can be extended(according to the authors) to include groups of patients, mediators, Board of Directors and "any complex organization of whatever size, so long as that unit is boundaried by behavioral commonalities and common reinforcers."

Though Tharp & Wetzel limited their application to home based reinforcement for school aged children, Pasaminic, Scarpitti, and Denitz (1967) applied community methods to home care program for schizophrenics, Fairweather,Sanders, Maynard, and Cressler (1969) operated a community business and Mayer & Meyerson (1967) ran an open facility for skid-row based alcoholics.

An interesting Community-Reinforcement procedure for treating and evaluating hospitalized alcoholics was developed by Hunt & Azrin (1973). In addition to using an excellent matched control design for evaluation, a time-out from reinforcement procedure was applied together with a program that was designed to rearrange the alcoholics' vocational, social, recreational and familiar satisfactions. The procedure applied operant analysis to problems traditionally handled in the areas of vocation, marital and family counseling plus some areas of social counseling. Reinforcer-Access counseling was complimented by use of existing hospital programs. Community service organizations were also employed.

After extensive analysis a series of agreements between patients and mediators were drawn up. In some cases where it was not possible to use the natural family of the patient in the mediators' role, foster families were arranged. The results of the treatment showed a remission of drinking and concommitant anti-social behaviors that differed significantly ($p < 0.005$) from controls. The experimental group drank less, worked more, spent more time with their families and out of instutions than the matched group. Community based programs are at the present time the greatest advancement of operant techniques into the human ecological net.

Kinesics and Communication.

The study of verbal behavior within the operant context is still in a somewhat rudimentary stage, though Skinner (1957) has laid a theoretical framework for studying it. (See Holtz & Azrin, 1966.) Consistant with other areas of the Experimental Analysis of Behavior, the emphasis has been on the relationships between the vehavior and environmental events correlating with behavior. The method has been to establish the conditions under which verbal behavior occurs and then to control the behavior through contingency management. The results have proved useful in control of stuttering (Flanagen, etal., 1959) restoring sppech to severely retarded psychotic patients (Thompson & Grabowski, 1972) and in teaching machines and programmed learning (Skinner, 1968). Premack,(1971à) created

a sensation when he produced symbolization in a Chimpanzee. But even this was surpassed b Washo (Gardner & Gardner,1971) a chimpanzee who learned to use sign language(in sentences!) after proper conditioning.

Anthropologist Ray L. Birdwhistell(1971) had in the meantime demonstrated the existence of a highly developed body language which plays a significant role in human communication. Like the Experimental Analysis of Behavior, Birdwhistell's system: 1) accepts learning as the basic mechanism, 2)is inductive and devoid of hypothetical constructs, 3) is descriptive and makes formulations solely at the behavioral level of analysis, 4) rejects premature structuring, employs complex recording equipment (camera zoom lens, etc) which acts as a cummulative record for classes of events which show correlations between behavior and the environment and 6)formulates the on going process as a behavioral stream with parallel events occuring at time intervals and in response to other events. Though rate and frequency are tacit assumptions in the Birdwhistell formulation, topography necessarily plays a more central role than in the operant systems. There have been no attempts to quantify the system.

The most elementary unit of Birdwhistell's Kinesics is a change in position of a part of the body. The event is called a kineme. These kinemes combine to form more complex units called kinemorphs which are classified as kinemorphemic classes. Complex kinemorphs are analogically related to words and the formulation is highly influenced by descriptive and structural linguistics.

The system divides the body into eight sections: (1) total head, (2) face, (3) trunk, (4) shoulder arm and wrist, (5) hand and finger, (6) hip, leg, ankle, (7) foot, and (8) neck. There are symbols noting areas and topography of movements which are combined with a numerical notation for representing angles. These are used to make kinegraphs which are written descriptions of both static body conditions and movements.

Communication, according to Birdwhistell is a multichannel process with kinemorphs acting (current to or independent of) speech to produce a communication episode. Kinemorphs, like the spoken language, are learned behavior, and are easily affected so that any mistakes by the investigator might result in the subjects' modification of the behavior. These units vary from family to family, between sexes, cultures, subcultures, social groups, individuals etc. Some examples:

> Less difficult is the order of problem occasioned by lower lid activity. Extensive research has revealed that its usage in the United States seems to be reserved to certain ethnic groups originating in Eastern and Southeastern Europe.
>
> Right hand grasps cigarette between 1a and 2a, palm out, 3,4, and 5 in crock (or curl). European male cigarette grasp. Or lighting hold American or European. (Birdwhistell, 1971).

Kinesics has been applied to situations that range between schizophrenic mothers changing diapers with conflicting kinesic motions, to cerimonial dances of tribes studied in an anthropological context. The economy and efficiency of the system is exemplified in the following quotation:

> Comparably, while the human face alone is capable of

making some 250,000 different expressions, I have fifteen placement symbols plus eleven special markers sufficient to record all the faces I have seen.(Birdwhistell, 1971)

Birdshistell's system (like Miller's and Skinner's) is formulated in concrete rather than abstracted or conceptual systems. It has been successfully applied in conjunction with psychotherapy (Scheflen, 1969) and is essential for studies concerning Personal Space (Sommer, 1969).

Physical Space and Behavioral Correlates.

The consequences of man taking over the earth's physical space and reforming it to fit a myriad of conflicting purposes has recently received the attention of a number of ecological groups. The dissenters have for the most part concentrated on the physical effects of man's changes on the physical and physiological well being of the organisms (wild and domestic) inhabiting the ecological spaces. To the psychologists, the behavioral aspects are more interesting.

In a huge, NIMH owned, barn on the outskirts of Bethesda Md., John Calhoun(1962) conducted a number of experiments where he systematically varied the population density and the topological aspects of physical space of several colonies of rats. It was a grim bio-social analogue to modern cities' crisis. As crowding became more severe, mothers did not care for their young, hierarchies of dominance and territories were established through tail biting and bloody conflicts. Sexual perversion and cannibalism became frequent and increased isolation accompanied the brakedown of normal social structures. Strange cancers occured with extremely large growths. Survival of individuals and the sacrifice

of the social groups became the rule. A science of space and behavior was feasible and necessary!

Sommer (1969) maintains that spatial and social orders serve similar functions. Thus there are spatial correlates to status levels, and conversely social correlates of spacial positions. Spatial segregation is therefore a pervasive principle of social organization. It functions as a shield between superordinates and subordinates and between in-groups and external influence. It maintains physical barriers to socially proscribed behaviors such as sexual arousal; and (together with physical expressions) acts as status symbols which are used to indicate, reinforce and insure the perpetuation of the existing status system. Sommer asserts that people actively defend certain spaces against intruders using the entire repertoire of defensive techniques in the animal, plus a few new ones!

Lyman & Scott (1967) classify human social space into four catagories: (1) public territories, like parks and museums, where people are given freedom of access but not necessarily freedom of action, (2) home territories, like pubs and clubs, which are public areas taken over by groups of individuals, (3) interaction territories, areas that have clearly marked boundaries and rules of access and egress where social gatherings may occur, and (4) personal space, an area with invisible boundaries surrounding a person's body into which no intruders are allowed without proper ritual. Whereas defense of territories hinges on visible boundaries and markers, personal space is defended by gesture, expression, posture and choosing a location that conveys a

clear meaning to would be intruders.

Individual distance is the characteristic spacing of species members. It is specified by the culture, for example, Englishmen keep further apart than Frenchmen or South Americans, though the distances may be greately affected by population density and territorial behavior. The social consequences of invading individual distance differ from those that result from the invasion of personal space. Violation of individual distance is an act against convention, society and good manners, but an invasion of personal space is a personal intrusion which demands proper deferential gestures to avoid conflict. Individual distance and personal space interact to affect the distribution of persons.

Two square feet is estimated as the absolute minimum distance that will be tolerated by a man in a crowd (fat people might demand more). Jacobs (1967) has a formula that equates crowd size with length x width of the crowd, divided by an appropriate correction factor for whether the crowd is dense or loose. People in dense crowds average six to eight square feet per person, while moving crowds (loose crowds) usually average about ten square feet.

Individual distance varies with the relationship between individuals. Strangers for example are affected differently than friends by a loss of personal space. Direction seems to be afactor since people are able to tolerate closer presence of a stranger at their sides than directly in front.

An institutionalized status hierarch such as that found in armies or corporations is accompanied by complex spatial

norms which may often exclude members of certain status groups from entering territories of other groups. An officer not being able to go into the enlisted men's quarters is one example, and workers suspecting that an executive who visits the work shop is spying is a similar example.

Sommer's method for exploring individual distance and personal space is to approach people and observe their reactions. Birdwhistell's kinesics (see above) is the system best suited for such observations, though GSR studies have yielded interesting information. Studies by McBride (see Sommer, 1969) show that the GSR is greatest when an individual is approached from the front and becomes less when the subject is approached from the side and least from the rear. The opposite sex gives greater GSR than the same sex, and a person generates a higher value than an object. Leipold (Sommer, 1969) showed that students given previous information which would have the effect of praise, neutral and stress sat closer to the experimenter when praised, farther away when neutral and farthest when stressed. Williams (1963) showed that introverts kept people at greater distances than extroverts and Sommer(1969) showed that schizophrenics maintain excessive physical distance to reduce the prospect of unwanted social intercourse.

Steinzor (1950) demonstrated that with minimal leadership, people directed more comments to those sitting opposite them in group meetings. Sommer has shown that pairs working together choose adjacent seating while competing pairs

prefer to sit directly opposite each other. Children, especially girls, prefer to work side to side and must develope the behavior of sitting opposite. It has been proven that the topic of conversation makes no difference, it is the relationship that determines the seating arrangements in groups.

Two relationships are of particular interest: 1) dominance, when one individual intimidates or threatens another, and 2) leadership, when one individual directs the other up. There is usually a relationship between these two variables, but the correlation is not unity. Esser (1965) was able to discern a relatively stable dominance among mental patients with the number of aggressive acts and dominance displays temporarily increasing at periods when there were replacements of patients or staff. Patients marked out territories on the wards and defended them. Many hospital patients feel that their territories and bodies are constantly being violated by staff and visitors.

James (1951) did a study on group sizes and found that of all of the groups that were observed (over 7,000) 71% were groups of two, 21% were groups of three, 6% were groups of four and 2% contained five or more people. In areas of higher population densities territorial behavior is replaced by social rank behavior, but noise levels, the size of the room (larger rooms seem to push people together) and other environmental factors can have measurable effects.

Sommer concluded that spacial relationships have powerful influences on behavior, but the interactions are of such a complex nature that single variable approaches are

inadequate. A question of priorities in design was discussed. For whom should spaces be designed? For the people using them, or for the people paying the designer. Should hospitals be designed for doctors, maintainance people, or patients. Schools can be designed for students, teachers or administrators. What are the consequences of compromises?

Summary.

General Systems is a science of systems, their structures, relationships, and levels of organization. It is apparent from the studies conducted in this area that there are certain properties and processes that systems have in common regardless of the level of organization. Miller's formulation is an attempt to define these processes and properties in terms of concrete structures, and to apply these definitions to group structure and behavior. Emergent qualities that occur at higher levels of organization are brought into sharp relief, as are the effects of stresses and strains upon the equilibria of living systems. But the gaps between theory, the lab and the society are still rather large.

The Experimental Analysis of Behavior has a structure that makes it impossible for a gap between theory and laboratory to occur. Its extension into the ecological net has, however, come in small discrete steps, with many of the early attempts bearing all of the signs of the laboratory origin. The discovery that non-technical personnel could be taught to observe, record, and reinforce behavior on contingency first lead to institutional programs, then to community based modification which is at this time the greatest extension of operant technology. This extension has made it necessary

to study organization, administration and systems in order to co-ordinate intensive programs.

A theory for the study of verbal behavior with operant methods was formulated by Skinner (1957). Though animal work and the clinical and educational applications of the techniques show promise, extensions out into the ecological net have been modest. The fields of anthropology, ethology, and small group ecology have, however, made significant advancements in the silent behavioral languages of kinesics, territories and personal space. These techniques have been applied to the clinic, architecture, and group psychology to great advantage. Physical space is obviously a significant variable in determining behavior.

CHAPTER VII

CONTROL & CONSEQUENCE

A Convergence Toward Ecology

Introduction.

The complexity of modern social problems has made it increasingly necessary for psychologists to work in connection with multi-disciplinary teams where integration of disciplines into a single delivery system places stringent demands upon both theoretical formulations and participants. Within this broader context, the psychologist is expected to communicate and co-ordinate actions with scientists from other disciplines. In some cases, he is even expected to take responsibility for designing programs that are comprehensive in scope and which have consequences in areas that might be far removed in structure and content from the limited interpersonal relations for which traditional psychological systems have been constructed. A new system is needed, one that is designed specifically for problems involving systems in an ecological context. Since no such system exists, psychologists have had to resort to an informal conceptual patchwork which has been almost impossible to communicate to other scientists and even more

difficult to apply.

General Systems Theory has evolved in response to the needs of modern social science, but even within the general systems context, psychologists and psychiatrists often find themselves confused by contradictory messages from areas within their own disciplines. This confusion often leads to psychologists occuping "honary" positions on inter-disciplinary committees run by politicians, attorneys, medical doctors, architects and social workers.

Auerswald (1969) analyzed the difficulty as being of structural origin and recommended an ecological approach as a solution. His ecological formulation required an eight step sequential process: 1) the collection of information, 2) the ordering of the data within a selected framework, 3)analysis of the data, 4) synthesis of the results into hypotheses, 5) the construction of a delivery plan for use of these strategies and techniques to test the hypothesis, 6) the construction of the delivery plan for use of these strategies and techniques, 7) the implication of the plan, and 8) the collection of data from the area of implementation to test its impact.

Any psychologist wishing to follow Auerswald's procedure is immediately faced with a choice between a myriad of competing systems. Since the basis of the choice and the subsequent implementation must be structural, an ordering of structures within some reference frame is necessary.

The systems described in the previous chapters were selected both on the basis of structure and convergence. Both of these properties will become apparent within the context of the following construction of a general ecological delivery system composed of strictly behavioral components. The resulting system is an ecological integration of behavioral systems.

Miller's General System.

Miller's system performs the function of formulating General Systems Theory into behavioral terms. This is a necessary step if living and non-living concrete systems are to be treated within a single frame of reference. The definitions and hypotheses of the Miller system are used to compare levels of analysis, patterns of organization, and functions of subsystems at all levels, The concept of "critical processes" is a guide to establishing priorities for processes performed by interdependent systems and components.

There are two ways to design a system: 1) design by analysis, where some standard model of configuration is modified to fit present needs, or 2) design by synthesis, where the form of the system is defined directly from specification. (See Di Stefano III et al, 1967) In the case of the former, the General System is used to evaluate the model by comparing it with other models in similar relationships. In the latter case, the General System helps determine the priorities in the specification.

It is, of course, very improbable that a psychologist working in an ecological context with a team of investigators will be able to do a structural analysis of related disciplines to determine interface differences where co-ordination of effort may be difficult. A general system does make it possible, however, to place related or interacting structures in context, and do joint experiments like those performed in psychopharmacology, or man-machine problems. Each investigator would of course be responsible for monitoring the units of his own discipline in such joint enterprises.

In cases such as the planning of psychological research hospitals, prison rehabilitation centers and community treatment systems where psychologists may be asked to be co-ordinator of a multidisciplinary effort, a general system is probably the only available method that is sufficiently formal and specific to allow for reasonably effective co-ordination, while at the same time not demanding detailed structural and theoretical knowledge of all of the participating fields active in the ecological net.

The generality of the Miller system that makes it possible to apply cross level hypotheses and communicate between disciplims is both the source of its strength and the cause of its limitation. This general system can be used to: 1) pinpoint a subsystem that is (or is not) functioning, 2) evaluate the consequence of any defects and the classes of corrections necessary for efficiency. But it is

not built to deal with specific procedures. It must therefore be supplimented by systems with structurs and relationships that lead to specific procedures. It can prove quite powerful, however, at points where the Miller system converges with more specific formulations.

General Systems and Disease.

The Miller formulation converges with Duhl's at the point and definition of survival. Failure to perform critical processes can therefore be substituted for the concept of survival so that Duhl's definition for "disease" (see pg 13) becomes:

> The normal biological, psychological or social means of coping with the stresses of the internal and external environments becomes defined (by persons given the authority, consciously or not) as disease only when the individual or group's biological, psychological or social ability to perform critical processes is jeopardized and some permanent or semi-permanent damage to the psychosocial or biological functions of man occurs.

The modification has the consequence that Duhl's definition is now anchored to concrete systems which can be used to specify the multiple factors contributing to the etiology. Be extrapolationg in any direction in space-time, the general system can then take in the complete range of factors contributing to stresses and strains upon equilibrium. It can for example explain distant, often multi-level relations like those encountered in the Bormann dilemma.

The Bormann Dilemma.

Martin Bormann, Hitler's private secretary, is an excellent example of a man who despite having powerful

enemies and lacking in some rather important talents, worked his way to the top of a system that was doomed to extinction. If a psychologist used the survival definition at the level of the nazi party or even the suprasystem of 1939-1945 German nation, he might conclude that Bormann was a survivor par excellence. At the level of the suprsupra-system (the world) however, Bormann was committing suicide. Failure to make supralevel analysis have lead too often to disasters in politics, environmental ecological crisis, business failures and therapeutic disasters. Of course many psychologists make such analysis on an "intuitive" level. But "intuitive" in the systems context implies making judgements for which there is little or no scientific basis-- in short, unanalyzed prejudice which can prove dangerous. General Systems often prove reliable in cases of chains of events that may influence critical processes by means of components quite removed from the organism in time and space.

The Experimental Analysis of Behavior.

The Experimental Analysis of Behavior can perform three functions in the ecological context: 1) It can be used to evaluate the relationship between the individual organism and its environment. 2) It gives specific procedures for altering these relationships and 3) It is a method of evaluating the effects of change of the environment on behavior and the points of interaction.

Though the concept of contingencies is probably capable of being generalized across levels, the S-R units and complexes of the Experimental Analysis of Behavior are

limited to their own level of analysis which is the behavior of individuals. When critical processes involve emergents (products of the systems as a whole) or when critical events occur at different levels of analysis, operant systems must be supplemented by systems of other levels.

Within the context of this delivery system, the analysis is used as a motivational system, a synthesizing system for individual behavior, an inductive system for evaluation of individual behavior, and to account for the mechanisms of learning.

It can be used in place of Bergman's learning formulation without losing the Pavlovian components. The expansion gained from this substitution is not only felt in the context of the clinic (see Ullman & Krasner, 1969) but throughout the whole area of psychology (see Honig, 1966), animal behavior (Hinde, 1970) and Behavioral Pharmacology (Thompson & Schuster, 1968). This system is used for modification.

Kinesics and Personal Space.

The kinesic message is an extremely rich source of information. In addition to information about anatomical structures, much of the family history, cultural experience, and reactions to momentary events can be inferred from comparatively small samples of an individual's kinesic behavior. Taken within the context of personal space, kinesics becomes a powerful indicator of social status, territorial behavior and cultural history. The convergence between physical space and human behavior is apparent by

the combined use in studies by Esser (1971), Sommer (1969) and Goffman (1963).

An important point of convergence occurs in the formulations by Scheflen (1969) where a synthesis of the communications systems--including the Korzybski school of General Semantics--and the clinical use of the Birdwhistell and Sommer synthesis form an important node in the ecological network. If the Scheflen formulations and structures are used as specific markers and processes within the information context of Miller's general system, effective procedures are united with an important systems process. If the Experimental Analysis of Behavior is applied as the learning base of the Scheflen formulation, a more precise control of the clinical process can be effected.

The Experimental Analysis of Behavior and Kinesics can both profit from a convergence and combination of techniques. This is quite apparent in a study by Barlow et al, (1972) where a successful treatment of transexualism is reviewed. Kinesic units concerning sitting, walking and standing were modified by means of operant procedures so that a male transexual switched from a feminine to a masculine kinesic role. This supports to some degree Birdwhistell's hypothesis that body language is sensitive to learning operations. It also supplies an excellent method of quantifying kinesics units and evaluating changes. Barlow et al. could have benifited greatly from the sophisticated notation systems and analytical methods of the anthropologists.

It can therefore be concluded that there is convergence between the Scheflen formulation and the Skinnerian behavioral system. Since neither a structural analysis nor a conceptual comparison reveals any conflict, there is no apparent reason why Scheflen can not use an operant base, and why this area of communication can't be analyzed by operant procedures.

Conclusions.

1) Structural and conceptual convergence of behavioral systems has progressed to a point where they can be combined into an ecological delivery system.

2) The Miller General System can serve as an overall reference system for the ecological delivery system.

3) The experimental Analysis of Behavior can serve as the learning base for the behavioral systems reviewed here.

4)Kinesics and Personal Space can be integrated into the ecological delivery system in such a way as to allow the resulting delivery complex to cover the complete level between sociology and physiology in the ecological net.

5) The resulting delivery plan can be used in an integrated approach with other disciplines that are based on concrete systems.

6) The Experimental Analysis of Behavior can be used as the procedural method for execution of the delivery system, with the Catania space acting as the procedural frame of reference.

7) That this delivery system is capable of being modi-

fied to fit most systems involving living organisms.

Summary.

The functions of Miller's General System, The Experimental Analysis of Behavior, Kinesics, and Personal Space in the context of a delivery system were discussed. There appear to be no structural or conceptual conflicts which could prevent the integration of these techniques into the system, so long as allowances are made for the limitations of each component system. There are a great number of points of convergence between the various systems which can be used to good advantage in the multidisciplinary contexts. The emergent delivery system appears to be sufficiently general for employment in most situations where behavior of organisms is to be evaluated at a level of analysis traditionally covered by psychological systems. The system is compatible with those of other disciplines that use concrete systems as their base.

CHAPTER VIII

BEHAVIORAL ECOLOGY AND THE PROBLEM OF ADDICTION

Introduction.

A more complete presentation of the two drug programs will be presented elsewhere.(see Dockens etal. 1972 and Götestam et al., 1972) What will be presented here is the use of the ecological approach that generated the delivery systems. The analysis is integrated in such a way as to determine (1) organization of systems and process (2) the relations of these process and organizations to human behavior and (3) the controlling variables which can be used to modify the ecology. Although rather extensive knowledge of the formal structures of the systems presented above is necessary for the actual application, enough is presented in the context of the previous chapters to show how a delivery plan from the system functions when resources, personnel and status of the ecologist are all minimal. The relationships between analysis and control, between theory and practice, between environmental events and human relationships are of particular interest. The language, the analysis and the solutions are all done within the framework of the Ecological-Behavioral delivery system.

The material reviewed here has been accumulated from studies covering a 1½ year period. It is a result of working first in the consultant capacity, then as head of a narcotics ward. The background information comes from many hours of interviews with addicts, personal contact, case records and field studies.

The Addict as Individual.

A drug addict is an individual who uses drugs frequently. Such individuals begin to have difficulties carrying out critical processes when (1) there is a change in priorities which leads to the individual participating in other behaviors to the neglect of the critical processes, (2) the drug related activities which have consequences that establish relationships with the environment which interfere with critical processes.

The relationship between the drug and the individual is such that drugs function as stimuli. It has been shown that stimuli have multiple functions, and in the case of drugs, there seems to be a number of novel interactions between several stimulus functions (see Catania, 1971, and Thompson & Pickens, 1971). But the basic relationships between drugs and behavior seem to follow the laws established in other studies of stimulus relationships. (see MacCorquodale, 1971). According to these studies, stimuli can be classified as having one of three functions: (1) eliciting, (2) discriminative and (3) reinforcing. Since the drugs most often associated with addiction enter into relatively powerful behavioral relationships, their effect upon the ecology of the individual can be quite extensive.

Addicts in Groups.

The extent to which the stimulus properties of drugs can interfere with critical processes in human societies depends to a large extent upon the relationships between the individual and those subsystems that carry out these processes. These relationships vary from individual to individual.

In western countries, most addicting drugs are given a legal status which establishes punishments and group sanctions against any individual buying, selling or using these drugs habitually. Though these sanctions are seldom sufficient to interfere with critical processes, the behaviors associated with these sanctions are of such low priorities that they qualify as powerful negative reinforcers on a Premack continuum. (see pg. 53) These sanctions therefore generate avoidance behavior on schedules which insure high frequencies and high priorities.

Even when addiction is relatively prevalent, the statistical frequency is such that few people have direct contact with drug addicts. There is therefore an increased dependency upon the mass media and rumours for information on addiction. This information often reflects the biases of the legal and institutional organizations to produce headlines like:

"DEATHS CAUSED BY DRUG ADDICTION ARE DOWN SO FAR THIS YEAR" (THE NEW YORK TIMES, SUNDAY, OCTOBER 15, 1972)

"KRIG MOT KNARK" (WAR AGAINST NARCOTICS) (DAGENS NYHETER, SATURDAY APRIL 21, 1973, STOCKHOLM)

The fear responses of most individuals to addicts is supported,if not induced, by negative reports in the mass media, and rumours which usually support these reports. The consequence of this is that people who have had little if any contact with drug addicts often indiscriminately apply negative reinforcers and punishment to addicts in the form of: kinesic movements, verbal attack, avoidance behavior, refusal to give employment, exclusion from family and club, poorer service in institutions etc. Since some of these negative reinforcements and punishments directly threaten critical processes, addicts often avoid conditions leading to these relationships. This can mean withdrawal from social intercourse.

While some addicts respond with behavior that leads to minimum contact with all members of society that do not perform critical processes for the addict, others form support groups which often have very strict rules, strong boundaries, codes of dress, special kinesic modes of communication, and sometimes group ethics and social philosophies. These groups are usually loosely organized and often discriminate between users of different drugs. Heroin addicts and users of depressants, for example, often do not associate with amphetamine addicts or users of central stimulants. And members of grcups using LSD and cannabis often avoid and exclude anyone using hard(central stimulants or depressants which are strongly addicting) drugs. They all have their reasons.

LSD and cannabis groups often have social codes and

rituals which demand a high degree of conformity to the group and a high degree of non-conformity to the values of the prevailing culture. The hyperactive behavior of central stimulant users and the withdrawal behavior of depressant users is not reinforced in these groups. Since stealing and aggressiveness are severely punished in the LSD-Cannabis groups, and this behavior often accompanies addiction with costly depressants and central stimulants, even group members are usually expelled from the group if they are discovered "hooked" on hard drugs. The low crime rate and non-aggresive behavior of LSD-Cannabis groups also affords them a lower priority on police lists, which groups can lose if known hard drug users and pushers (those who sell drugs) are known to frequent the territory.

Chronic users of depressants who are deprived of the drug for long periods (8-72 hrs, depending upon the drug) go through a withdrawal process which can be fatal. (see Jaffe 1972.) Withdrawal symptoms progress from yawning and perspiration in the early stages to nausea and vomiting, intestinal spasm and diarrhea, accompanied by alternating sweating and chills inlater stages. Withdrawal threatens all critical processes, creating both stresses and strains on the individual. Stimuli associated with withdrawal become powerful negative reinforcers for these addicts. Theri avoidance behavior can therefore become quite extreme and is reflected in their willingness to pay high prices and behave in anti-social ways to obtain drugs. The depressant drug groups are usually smaller and more tightly

knit than the LSD-Cannabis or the central stimulant groups. They often rank themselves highest on a social scale for addicts and consider it a loss of status to have to associate with central stimulant users.

Amphetamine and central stimulant users do not go through a withdrawal complex like that of the depressant addicts. The pattern of use is peculiarly cyclical with periods of high activity alternating with periods of sleep. There is danger of development of hallucinatory behavior, aggressive, sometimes violent responses to slight provocations makes stimulant addicts feared in some areas, and serves as fertile ground for fantasy in the mass media. Their sudden flights in mood and hyperactivity is exceedingly irritating to the two drug groups discussed above, but they do form their own groups.

All three groups serve the function of communication between drug sources and addicts. They also give warnings before police roundups, and act as community buyers when the price of drugs--usually brought about as a consequence of police crackdowns--become expensive. The groups also function as discriminative stimuli for the drug experience, and through association may acquire reinforcing properties.

Though U.S. and Swedish group patterns are similar, there are some marked differences in both the choices of drugs and the social distance between groups. The social distance between swedish groups is so great that they wait in separate clusters in socially guarded territorial spaces for deliveries--by the same pusher at the same time! The

central stimulant users wait in one group, the central depressant users wait in another, and rarely do people cross the invisible boundaries between them though they are but several yards apart.

Break with Society.

Since the great majority of individuals in modern societies are dependent upon subsystems of the society for the performance of critical processes, social sanctions can have serious consequences that directly threaten the survival of the addict. Whether the reason for beginning the addiction be social, medical, or some interaction, chronic drug users eventually find themselves involved in a chain of events that leads to significant disruptions in his ecological relationships. When and how depends upon the individual ecology.

A jazz musician, for example, will usually not face social sanctions until his addiction affects his competence. Central depressant users have been known to continue for years without either the public or anyone outside of a small circle of friends knowing of his dependence. And even if it were known, the chances of it affecting his status is rather slight. The break with society usually comes when drugs or money become scarce so that drugs take priority over food, meetings with pushers take priority over practice, hallucinations drive him into isolation, or a physical and/or psychological breakdown lowers the level of his performance.

Others with more socially demanding life styles may make the break sooner. In many places of employment such as schools,

or hospitals, mere detection is sufficient to terminate employment. The family that has been exposed to one or two withdrawal episodes and several periods of privation due to the price of drugs has a small chance of surviving the stress and the threat to critical processes.

Accidents from overdose, or behavior while intoxicated can lead to discovery and the imposition of sanctions which not only affect the addict, but his family and associates. Then there is the preoccupation with drugs and/or withdrawal which motivates the addict to limit his behavior to those that help him to acquire drugs.

With normal channels of revenue blocked by social or physical factors, the addict may be forced into antisocial behavior such as stealing, drug selling, or prostitution which when discovered will lead to even greater disruption of his ecological relations.

The sum total of these ecological relationships often leads to the eventual dependence or death of the addict. In the case of dependence, a chain of dependence begins with those nearest to him and usually continues until it reaches a hospital or some other institution which hopefully can mend, alter, or modify the ecology.

The Hospital Problem.

The biological aspects of drug addiction as well as the origin of the drugs themselves lead to drug addiction's being classification as a "medical" problem. The logic of its being included in this catagory is reinforced by both

the serious biological consequences of withdrawal and overdoses as well as the occasional "psychotic" behavior that can occur from excessive use, especially in the case of central stimulants. The traditional methods of treatment employed detoxification (usually a gradual withdrawal) and a rehabilitation program. (see Jaffe 1972) Both processes were carried out in a hospital setting and follow up studies of opioid users have usually shown a relapse rate of over 90%. Voluntary groups and self-regulatory communities have (according to Jaffe) produced no satisfactory follow-up studies and have had relatively low numbers of participants who enter, or complete the programs. Supervisory-deterrent approaches where addicts are put in either a hospital or a prison, then supervised carefully after released have not been successful, but methadone maintenance together with rehabilitation procedures have yielded good results. Group therapy programs (Jones, 1953) are also being attempted.

The withdrawal process demands medical attention for which hospitals have the best facilities, but the re-establishment of the ecological relationships which will allow for the functioning of critical processes is to a degree hindered by hospitalization.

The delivery system employed here offers two procedures for extinction: (1) failure to follow the reflex with a reinforcer, and (2) the association of incompatible reflexes with eliciting or discriminative stimuli. It is quite ap-

parent from the relations described above that the goal of the procedure should be to establish behaviors, the consequences of which should lead to the performance of the critical processes necessary for the survival of the individual.

In this context, to isolate the individual from the community is also to isolate the patient from the contingencies that set the occasion for both the drug taking behavior and the concomitant, supportive behavior that interferes with the relevant relationships. This implies that the hospital must either use representative stimuli to establish behaviors of very high operant levels(probability of occurance) and that are readily generalized to specific, individual, circumstances. Or it must establish behaviors that have as their consequence the avoidance of the contingencies under which the maladaptive behaviors occur. Both of these alternatives are difficult with the present state of behavioral technology.

In addition to the technological difficulties, hospitalization leads to further disruption of the individual's ecology. Part of the difficulty is linguistic. When an "individual" goes to a hospital he becomes a "patient" who is by implication "ill." If it is a "mental" hospital he is by implication "mentally ill." If it is a special hospital for the treatment of addiction, then he is an "addict" with a "record" of addiction. Most job applications and insurance applications(which are often associated with employment in

important ways) have spaces which ask questions about "health". And last, but by no means least, truthful answers to these questions are discriminative stimuli for the type of behavioral interactions which have already been described as contributing to the breakdown of the important social relationships necessary for survival. Thus hospitals do not treat the original problem. They treat the original problem compounded!

The Ulleråker Problem.

Ulleråker "Mental Hospital" is located in Uppsala, a university town of about a hundred thousand inhabitants. Like most swedish hospitals, it is state supported, which makes it particularly vulnerable to adverse publicity. Drug addiction was treated and studied in four wards, all under a professor who headed "the Department of Research."

The problem ward contained female individuals who were for the most central stimulant "addicts" and for various reasons became "patients" on the "narcotics ward" at "Ulleråker Mental Hospital "

Preliminary Investigation.

Early information sessions revealed a traditional (see Fig. 1) ward organization with formal authority deligated according to a strict hierarchy with the head doctor on top, the patient on the bottom, and the keys to the locked ward acting as the only visible status symbol between patients and staff. There was about one staff member to every two patients(though this figure varied slightly in practice) and frequency of contact estimates indicated that nurses had fre-

quent interactions with the patients. The positive reinforcement contact was limited primarily to custodial duties. And with the exception of the administration of medicines, the nurses had a relationship to the patients that was almost identical to that of a service person in a lower priced hotel. The nurses resented this and the patients who threatened and constantly made demands on them. The turnover of the ward personnel reflected the punishing nature of the ward relationship and the status of the ward which was one of the least desired assignments at the hospital.

The physical appearance of the ward gave the initial impression of being small, clean, comparatively modern, tastefully decorated and well cared for. According to the principles of functional design and personal space, however, it was built for maximum privacy and minimum contact between people (see Fig. 6). Storage rooms physically isolated the sections most often frequented by staff from those inhabited by patients, thus dividing the ward into staff-patient territories complete with physical boundaries. A closed door thereby became an exceptionally effective barrier which required an overt violation of personal space and individual territory to transverse. Furniture in the dayroom was dominated by long sofas that were arranged along the side of the walls. Ward meetings were influenced by this arrangement to sucha a large degree that people often had to get up and walk or drastically change

position in serious or important meetings. From this it was concluded that physical space would have a significant effect upon the project: (1)Making observations would be difficult for the staff, (2)the physical space would reinforce the social isolation of patients from staff. 3) the ward design would discourage contact between patients (see Sommer, 1969). The conclusions were confirmed by subsequent events.

Orders of speaking, frequency of agreement and the accompanying kinesics in a meeting with the doctors and staff as well as seating arrangements confirmed the group organization indicated by Fig. 1, 1. There were however, a number of indicators pointing to the fact that the head nurse held the dominant position on the ward.

At this point two types of analysis were necessary: (1) a general systems analysis concerning information transmission and group structure,(2) a behavioral analysis for procedure and motivation. The two systems converge at Tharp & Wetzel's(1969) triadic model embedded in the social environment (see Fig. 5). "Convergence" in this context is the same as saying that one could arrive at identical solutions by use of premises from either system, and that no changes in structure are necessary to accomplish this.

In this case one could assume that the ward personnel was a group and that a reinforcement program was the product. (see Miller above.) A task analysis quickly reveals that the head nurse has associator, memory, decider, encoder,

input transducer, and decoder functions. A look at the organization (Fig. 1,1) shows that only the social worker could compare with the head nurse as a communications center. An analysis of the types of information transmitted immediately eliminates the social worker, so the general systems solution is to work through the head nurse, but how?

Here one applies Tharp & Wetzel's triadic model which is based upon the premise of mutual reinforcement. This process is rather complicated, but what it amounts to is a repeated application of contingency analysis to every member of the group to determine who reinforces whom and with what. In this case the head nurse once again emerges as the central figure for she serves as the reinforcement mediator for the staff.

Both analyses indicated that the ecologist should not attempt any great modifications of the existing social or organizational structure. He should instead concentrate on strict programming of the staff (see Miller hypothesis 2-1, 1965) which in behavioral analysis terms means contingency management at the staff level. The staff would then in turn mediate for the patients.

Elimination of the patient behaviors that are most irritating to the staff should function as sufficient reinforcement to maintain staff participation until such time as contingencies warrant a change in structure. And at this point, the ecologist must be careful as to how he manages changes in dominance and territorial spaces. It is usually

better to allow th structure to evolve than to risk threatening any position. The stability gained by this strategy far outweighs the temporary loss in time and efficiency.

Two lists were then drawn, one of the available reinforcers, the other of the types of ward behaviors that should be reinforced and/or extinguished. The ward was limited to the budget and the reinforcers that were available at the time. Since these were of low value, the only recourse for the ecologist was to use Premack's Principle (see above) as a method of utilizing relatively weak reinforcers.(Homme, 1966)

In the case of ward behaviors, the choice of behaviors is usually made by selecting those that come nearest to behaviors that would be reinforced outside of the hospital. A daily schedule that will establish daily rhythms comparable to a normal day is then built around these behaviors, with allowances for planning activities included--as needed.

The critical behaviors must of course be chosen on the basis of the individual's ecology, including his group memberships, learning history, goals, abilities, etc... The process of arriving at decisions is essentially the same as that used on the ward; first a general systems analysis, followed by a behavioral task-reinforcement analysis. A contingency program utilizing reinforcement principles is then implimented, making use of all available support from the individual's environment. (Hunt & Azrin, 1972) It should be noted here that one of the primary goals of the contingency programs is to neutralize the isolation effects of the institutional environment and maximize favorable re-

lationships between the individual and his environment outside of the hospital.

The triadic model assumed the second form (Fig. 1,2) during the two week training period when personnel were taught the principles of contingency management, using a swedish translation of Schaeffer & Martin(1969) as a textbook. The ecologist has the role of behavioral psychologist(consultant), the behavioral analyst is a psychologist familiar with behavioral techniques, and the clinical doctor functioned as administrator in addition to his traditional roles on the ward. The final ward organization is seen (Fig.1,3) where the behavioral analyst actually administers the program through the head nurse, and the co-operation of the behavioral psychologist and clinic doctor. Nurses acting as mediators carried out a few test trials using the methods to demonstrate to themselves the techniques and their effects.

The three phase program is represented by the digraph and matrix in Figure 2. Phase 1(P/1) is the detoxification phase where the patient is under the influence of the drug. She remained in this phase until urinalysis showed no traces of the drug in the urine. She was then given the option of continuing to higher phases, or accepting the help of the social worker in arranging to be discharged from the hospital. The treatment phase(P/2) differs from the detoxification phase in two respects (1) the patient has a double room instead of a single room, and (2) the patient is allowed to leave the ward in the company of personnel. Both of these relatively high frequency behaviors are used to reinforce

behaviors of lower frequency. The third phase is the rehabilitation phase (P/3) where activities outside of the ward added to the low frequency behaviors, and visitors, longer leave from the ward (unaccompanied by personnel), plus a private room with visiting are added to the high frequency side. Patients fulfilling the contingencies followed the straight lines T2, T3 in Figure 2, while failure to fulfill contingencies lead back to an earlier phase as in T4, T5, and T6. At the bottom of the figure is a matrix which gives the same information in tabular form. Note the clarity and accuracy of the mathematical forms of presentation. In more complex relationships a great deal can be gained through using graphic and matrix forms to supplement symbolic processes in difficult analyses.

The top portion of Table III gives the Premack frequency relationships for phase 2 and the bottom portion reviews reinforcer relationships in phase 3. It is important here that the behaviors used as reinforcers are Personal Space variables. They interact with the behaviors specified to produce the effect described by Premack. But the fact that they are made contingent by the programming is as important as the principle describing the relationship.

The change relationships between personnel and patients that resulted from the implimentation of the behavioral techniques were quite reinforcing to the ward personnel, who now began to experience positively reinforcing relationships with the patients. There were still

some conflicts, however, when patients experienced the time out from reinforcement associated with going back to a lower phase. Both personnel and patients complained that the criteria were too arbitrary.

These conditions were corrected by associating points with each activity, in such a way that the high frequency behaviors received the lowest number of points and visa versa. Table IV shows the point assignments, frequencies of opportunities and maximum possible points for various activities. Five points a week were required for moving out of phase 1 and twenty-five points were necessary for moving from and remaining in phase 3.

The resulting contingency program was a token schedule (see above) and the resulting behavior was that typically found in token reinforcement schedules. Frequencies of reinforced behaviors were higher than baseline rates taken during the month before the program was introduced. Unreinforced behaviors declined over the same period. Program II(the token schedules) was more effective than Program I(Premack contingency relationships alone) and Program I performances were superior to baseline. Figure 7 shows the differences between the three periods and phases as to their affect upon the total number of patients' rising and dressing behavior. Figure 8 shows the same effect on individuals. A Kruskal-Wallis analysis showed a significant difference ($p > .001$) between frequencies of both programs when compared with baserates. The prescription for drugs (see Fig. 10) and the number of times the physician was called to the

ward (see Fig. 11) both decreased during the two programs.

Covert Conditioning.

A program of covert conditioning (Cautela, 1970, 1971a, 1971b, Götestam et al.,1972) was also carried out on five of the eighteen patients. It is a three step procedure: (1) the patient is asked in an interview to describe,in detail, the conditions under which she injects drugs. Two or more of the most frequent situations are recorded. (2) The scene is presented to the patient and she is instructed to imagine, as vividly as possible, that the situation is actually occuring. (3) But instead of being reinforced, she is to imagine that the drug has no effect! A staff member helps her in the beginning, but after the patient masters the technique, she does about 15 trials a day by herself. Before treatment and during the sixth day of treatment, physiological reactions; respiration, pulse rate, pulse volume and galvanic skin response were recorded on a Grass recorder for one of the cases(see Fig. 12). There were concommitant physiological reactions following instructions to "imagine" the situations in earlier trials, which did not occur in later trials. Four of the five cases studied reported that the drug had no effect when taken under real conditions after the treatment. In some of the cases a companion who took the drug at the same time experienced the "flash" but the patient felt nothing. A nine month follow up revealed that three of the patients were still drug free. This effect is interesting when viewed in the light of a quote from B.F. Skinner(1969):

The reinforcer is not at first contingent on any particular form of behavior; but when its effect has been felt (and, particularly, when withdrawal symptoms have developed), is prevented simply by making sure that the effect is never felt. (pg. 58)

The Methadone Problem.

The behavioral program described above started Aug. 31, 1971 and ended April 23, 1972. Shortly after the last mentioned dated, the ward was switched over to Methadone Maintainance. The therapeutic program consisted of detoxification from morphine derivatives (this took place on another ward) followed by administration of methadone. The dosage of methadone was gradually adjusted until the patient felt neither abstinence (actually pre-withdrawal stimuli) symptoms nor euphoria. The patients were not allowed to leave the ward without being accompanied by personnel. There were no leaves, and no systematic program on the ward. The ward personnel that had administered the program described above were still employed on the ward though there had been some turnover.

Preliminary Study.

The ward was almost continually noisy with patients complaining about abstinence symptoms. It would not at all be exaggerating to say that the sound of voices was like a continual roar in the ears of the personnel who complained that when they went home they couldn't forget the ward. They had trouble sleeping, and when they did sleep, they dreamed of the noise and the nagging. Several serious physical threats and an almost total breakdown of

the ward structure lead finally to a request for another behavioral design for the ward.

The social organization on the ward was a formidable deterrent. The patients had formed a very loosely organized anti-personnel group, which had very closely knit cliques as subunits. By use of rumours, distribution of information, and the use of interdepartmental and personal rivalries, the cliques had managed to use the system against itself.

The drug and the ward environment often interacted in a way that was detrimental to the relationships between staff and patients. The heating system did not always keep pace with the changes in temperature so that some of the patients interpreted their chills as being caused by too low dose of methadone. Indeed, the whole atmosphere of conflict and intrigue centered around a game structure that would have delighted Rapoport(1970) and Bernes(1964).

The staff believed that the patients were trying to "fake" symptoms that would lead to euphoric doses of methadone, and the patients believed the staff was trying to see that they got as little methadone as possible. Each accused the other of being dishonest. The interactions between the small locked ward, the games, and the effect of the drug (which continually confounded analysis) and the absence of activities set up the contingencies for continual conflict.

Threats.

Threats against personnel took three forms (1) direct attack(one time with a knife.) (2) a promise to pay someone

to attack a staff member, and (3) to contact the evening press so as to bring public pressure to close the ward. The conditions under which direct attack was threatened followed a constant pattern. It concerned a rule that stated that if the patient did not pick up his methadone within the alloted time, he would have to wait until the next scheduled opportunity which was twenty-four hours later. Since the patients were constantly comparing the effects of methadone with those of morphine, which is shorter acting, they interpreted the time out period as a prelude to withdrawal and reacted violently.

Some of the patients wore the long hair and beards which have become stereo-types for non-conformists. This set the occasion for social sanctions by non-group members, and served as a boundary and means of recognition for group members. An extensive drug group vocabulary and a high frequency of drug related conversations also tended to socially isolate the addicts from the community and the staff. There were several drug related kinesic markers, like condition of pupils, a characteristic rocking and shaking of the foot posture, as well as some rather complicated gestures which serve as information markers for group members, and boundaries for non-group members. (Early analysis of group structure was hindered by my failure to accept the extreme specificity of the group structure.) Drugs and physical location were the only characteristics that the cliques

making up the group shared!

Extensive conversations with several of the patients lead to a written document with three suggestions (1) more frequent contact with doctors, (2) passes and a chance to see how the methadone dose functioned outside of the hospital, 3) group meetings and some degree of self determination.

Preliminary Conclusions.

Confinement, social structure, physical space, faulty communication, cultural-political differences, input lack, and an unstable physiological relationship between individuals and drugs combined to create a dangerous ward environment. A token system could relieve the boredom, but the confinement had to be alleviated as quickly as possible. The conditions had deteriorated to such an extreme point that even if left alone the situation would show improvement in a reasonably short time. The stresses and the strains on the system were so great however, that the equilibrium reached might be at the expense of serious physical and/or behavioral damage to the individuals who comprised the system. The hostility between staff and patients had progressed to such a point as to lead to rearrangement of group preference so that depressant users began to take advantage of visiting privileges to escape to the company of central stimulant users.

The working conditions not only threatened the physical health of the staff, but the psycho-social relationships as well. An example of the types of stress--in less than fif-

teen minutes, the office door was banged shut twelve times with a demand and a shout to the head nurse preceding each bang!! On one occasion two femal staff members sat crying and isolated in a back room after being physically threatened by a male patient.

Solutions.

Contingencies were analyzed for possibilities of mutual positive reinforcement for each individual. This was manditory because the patients'group was too loosely organized to be reinforced as a unit, and the modification of patient behavior was the only relevant reinforcer available for application to the staff as individuals or a group.

The communications problem was solved by using parallel channels(Miller, 1965). In this case it meant that the contact man was always present when the patient had a conference with another staff member. Each patient was assigned two mediators(contact men) so that free days and vacations would not interfere with the communications process. Mediators conferred closely with each other and with other staff members in daily formal and informal meetings. The night shift came one half hour earlier so that they would have sufficient overlap with the day shift to confer on necessary matters so that the staff could maintain a consistant program 24 hours a day.

A patient was employed as a staff member, an ombudsman, to act as a communication link between patients and staff. During the period covered by this report, the author occupied

the position normally assigned to the clinical doctor. He had the help of medical doctors for physiological problems, but the behavioral program was executed by the regular ward staff.

Individual programs concerning the methadone dose, community oriented behavioral programs, drug related symptoms, leave, employment, family problems etc. were planned during meetings between the patient, the mediator, a social worker and the investigator.

A token schedule where points were exhangeable for leave from the ward (see Tables I and II) was programmed. Urinalysis was done on a routine basis, and any drug in the urine that was not prescribed by the program lead to loss of a sufficient number of points to require that a patient lose his leave for the week. If threatened, the mediators were instructed to accede to the demand, but the patient making the demand was to understand that he had just terminated his relationship to the program.

Results.

The immediate reaction to the token schedule was positive for the staff, but the patients refused to have anything to do with it! Since it was difficult for them to find reasons for objecting to having to choose between activities like: getting up and dressing in the morning, cleaning their rooms, excercise, going swimming and attending occupational therapy, the patients argued that it was the points that they objected to. They felt that "adults"

should do these types of activities "automatically."

Baseline data taken two weeks before the introduction of the program had shown however that less than half of the patients engaged in any of the activities that "normal adults" should do "automatically."(see Figures 13-23) But remaining with the methadone program was not made contingent upon acquiring any points. The only advantage to acquiring points was that they could be allowed to leave the hospital and ward unescorted for as many as three days. (see tables I and II)

The patients also objected to individual meetings and programs and demanded group therapy like that practiced on another ward, and in other hospitals. They physically stormed the first "individual" conference. And lead by a clique of patients who had presented the "demands" mentioned above they held a group meeting. At a later meeting they soon discovered that all of their original demands had been worked into the program and that the resulting schedule would allow them freedom to either accept of reject the point system (on an individual basis) and they could engage in whatever activities were practical at the same time. The meeting ended in clashes between individual cliques over alternate demands and programs.

At the end of the first week there were a number of boarderline totals, but it was clear that the majority of the patients had accepted the program. The results can be seen in the Figures (13-23). "A" shows the baseline perfor-

mance before the program began, while "B" shows the first week of the program. "C" shows what happens if a physician who doesn't apply the program takes over when the behavioral analysts are away for two weeks and "D" shows what happens when we returned. "E" shows what happens when the total points necessary for reinforcement is lowered and "F" shows what happens when the system goes back to normal.

Conclusions.

The altered contingencies combined with patient turnover to totally reverse the social conditions on the ward. Patients began to express preference for the ward even to the point of not taking advantage of their leaves. This was due to the fact that the city of Stockholm (where most of the patients lived) had acquired powerful stimulus properties, which some patients said affected them the second they got off the train. Also the environment in Stockholm had been so structured around individual drug behaviors that it was difficult for some of the patients to resist falling into old behavioral patterns.

Some problems with individual programs emphasized the necessity for a broader approach. While some patients used methadone as a physiological baseline, and went about ordering their ecological spaces to support normal processes, there were others who maintained very serious strains in their relationships. Having built up a history of punishment and negative reinforcement in their relationships with the non-drug oriented environment, new starts were easily

extinguished by: impatient bureaucrats, long waiting periods, changes in personal relationships that took place while the patient was hospitalized, schools that denied them admittance, an inability to concentrate caused by physiological interactions between complex higher order behaviors and methadone, an inability to find reinforcing employment(or any employment at all) and pressures from the drug community.

The learning principles that form the base of this delivery system indicate that these people should temporarily be protected from failure (negative reinforcement and punishment) in critical areas until they can build up the behavioral repertoires to adequately cope with them--but this should not be done in isolation. A two week period in the hospital may be necessary to determine relationships between the individual and the dose of methadone. Those needing psychological support should then be taken on an outpatient basis, or in more severe cases, they should be treated in a halfway house program. There is considerable support for this argument.

A program for restructuring the ecology of an addict becomes highly theoretical if the patient is not really interacting with the environment in ways which will indicate specific problem areas. In the hospital environment the staff was able to contact agencies, schools, and possible sources of employment, but after contacts were made and the patient was "signed up" there was no way of ascertaining what type of relationship the patient established with these institutions. For example, schooling in Sweden is a highly

competitive process. The development of effective study techniques and the budgeting of time can be critical in this context. Discussing these variables with the patient or the institution in a way that will not discourage the patient is difficult if there are no concrete problems with real solutions. In short, the program should deal directly with the contingencies set up by ecological relationships. Since these are difficult to simulate in the hospital environment it is better to operate on an outpatient basis.

Several ethical and administrative problems occurred in relationship to methadone that are quite significant in pointing out the necessity of an ecological approach. It is quite apparent from the previous discusion that the delivery plan reviewed here is most probably capable of taking a powerful reinforcer like methadone and constructing a program that would have rather spectacular results upon the ecological relationships of the patients. Why then is methadone used in such an indirect association with the program rather than making the acquisition of methadone contingent upon patients'behavior? The reasoning her would go something like: "If the mafia can do it for evil, why can't the "society" do it for good?"

Such an approach could be justified only under the condition that within a reasonable time(as defined by the patient!) the program would lead to a totally drug free relationship between the patient and his environment. Otherwise, the result would be slavery.

The indications from interviews, observations, and data in this study are that when even relatively weak reinforcers are made contingent on behaviors, the frequency of these behaviors are controlled by these relationships. If the behavior that is reinforced leads to the performance of critical processes, then the survival of the individual is insured. If the individual is then taught to maintain these relationships, and given the control over the necessary reinforcers and contingencies then the result clearly falls within the accepted ethic of individual determination.

There are very strong indications that even the most sophisticated addict (those that are medical doctors by profession) is incapable of maintaining a control over his own ecology if the stimulus properties of powerful drugs become variables. The study at Ullerâker Hospital indicates that one of the variables associated with drugs is probably related to an interaction between threshold drug effects and behavior. Events with strong emotional components, physical illness (especially upper respiratory illnesses), lack stresses and previous injection patterns all appear to bear some complex relationship to patients' judgement of a "satisfactory" dose. Not being able to sleep at nights (possibly a side effect of the drug) also seems to compound the problem and lead to demands for higher doses or supplementary drugs to deal with the sleep problem. These factors should be studied under laboratory and field conditions so as to ascertain if they might be controlling variables in relapse

and overdose behavior.

At any rate, it seems highly improbable that most patients can maintain a satisfactory relationship with methadone as a permanent relationship without continual ecological support from a number of systems including medical, psychological, social, etc...

The sociological aspects of methadone programs should also be considered before one thinks in terms of making behavior contingent upon methadone. Two patients were strongly attacked, one by a psychologist, the other by a psychiatrist, for even participating in the program. Rumours about the program being discontinued also created difficult crisis situations for some patients who felt that they were benefitting from the program. It is quite apparent that the ambivalent status of the patients in the socio-ecological structure needs serious attention. And the newspaper reporters and editors should be required to study more important aspects of the problem.

CHAPTER IX

THE STRUCTURE OF BEHAVIORAL ECOLOGY

Behavioral modification in the ecological context can be defined as the use of reinforcers for the operational partitioning of the environment. The target of this operation is the behavioral stream of individual organisms and the goal of the operations is to establish specific relationships between the behavioral stream and portions of the environment not included in the behavioral stream. Behavioral ecology is then the study of the consequences of different types of partitioning on the environment.

A basic ecological assumption is that individual organisms occur as interrelations among environmental events. For reasons of convenience, these environmental relationships may be viewed as a complex of interlocking systems and subsystems. Unlike General Systems Theory(see Bertalanffy, 1969) which uses mathematical equations to abstract systems' relationships, behavioral ecology must deal with formulations which having just been discovered, have not had the benefit of such a high level of mathematical integration. The establishment of continua so necessary in ecological formulations must therefore depend upon other methods which can be applied for integration of partially quantified relationships. One of these methods is the structural

integration process suggested by Auerswald and Miller.

The Miller General Systems approach to group behavior allows the ecologist to make several simplifying assumptions in respect to the two ward environments that were modified in the studies reviewed above. The most important of these assumptions concerned the postulates which allowed the ecologist to formulate the ward problem as an interaction between systems and subsystems. All of the systems of which the ward is a subsystem: the hospital, the Swedish Government, the University, the city of Uppsala, the society, etc., make certain demands and requirements upon all persons on the ward.

Each patient and staff member, in addition to belonging to the ward, also finds himself a member of a number of socio-economic systems: the family, schools, businesses, friendships, etc. The relationships between patients and the systems that he or she has relationships with outside of the ward indicate the specific portions of the environment that must be modified if the patient is to survive in a specific environment.

Miller's formulation, in addition to pin pointing many behaviors that serve as indicators as to the nature of the relationships that patients and staff have with other systems, also suggests disciplines which deal with these behaviors. Sommer's personal space studies, and Rapoport's game theory are two examples of systems which Miller suggests act as useful complements to Miller's own postulates which he derives from communications theory. The spacing of staff and patients were important variables for judging social hierar-

chies during the study, and the use of social workers and contact men were clearly strategies that could be derived from Miller's postulates about communications nets, especially those involving parallel channels.

The fact still remains, however, that a general system is not specific enough for the precise manipulations required on the psychiatric ward of a state hospital, especially if that ward is in a state of crisis. The goals of several of the patients conflicted rather violently with those proposed by both the ward personnel and the surrounding environment.

Though co-operation and communication under such circumstances could be expected to be minimal, an analysis in terms of communications feedback theory could not be expected to give more than a clue as to what variables needed modifying in order to stabilize the relationships in the ward environment so that the survival of the people there would no longer be in jeopardy. It is also doubtful that the analysis of drug relationships in terms of communications and group goals would be sufficient for determining the effects of drugs on environmental relationships.

In the ecological context, the Miller theory is thus a method of partitioning the environment into relevant and irrelevant classes of behaviors. It therefore takes the place of the "rule of relevance" which is actually a less precise, less formal method of accomplishing the same thing. The effects of this method of solving the problem of relevance will be apparent by the end of the chapter, but first, a

discussion about several simplifying assumptions regarding the behavioral stream and contingencies of reinforcement.

Partitioning the Stream.

Even under normal conditions, it is difficult not to be impressed by the complex series of events in time which define the behavioral stream. But given a crisis situation involving patients, drugs,a society and a hospital staff, the mere consideration of the possible structural parameters poses a formidable problem. Add to this the operational partitioning of a host of converging, interacting, mutually exclusive, complementary streams and the resulting complex is a multidisciplinary problem of the magnitude of those encountered in traditional ecological and systems research. The alternative solutions must of necessity be in the form of manipulable variables. But the question is, which variables?

Unlike the individual classes of reflexes one isolates in the laboratory, the clinic is characterized by operant groves and pavlovian reflexes that occur in mixed sequences which may contain series of responses without apparent intervening stimuli and chains of stimuli that are followed by chains of responses in different orders. All of these are related to other environmental events and to each other in ways that can be influenced by a host of behavioral modification procedures, but the first problem is to order the events and the procedures within a unitary frame of reference which is characterized by a continuity of process rather than the traditional dichotomies and conglomerates.

This is accomplished by the use of the mini-systems.

By assuming Schoenfeld et als'(1956) formulation of the behavioral stream, it is possible to partition the stream into a continuum of response and non-response classes by means of reinforcers. The reinforcers can thus be conceived as being introduced along a time axis, a fact that in this context has profound practical and theoretical consequences.

In place of the traditional dichotomy employed in describing schedules of reinforcement, both the interval and the ratio schedules can then be generated operationally by using two time axis according to the t-tau systems. The laboratory procedures are rather complex, but they can be summarized in principle by dividing the time axis into two sequential periods which differ in the probability that a particular response will be followed by a reinforcer. This is the primary or Tau time axis. Each of the periods of the Tau axis can then be subdivided into similar sequential periods to produce the secondary or t-time axis. By using the primary axis as a measurement scale, and the secondary axis as a scale for introducing reinforcers, Schoenfeld et al. have shown that in addition to the traditional ratio and interval schedules of reinforcement, new schedules that have never been studied or properly classified can be generated.

Mentioning the complex procedures of the t-Tau systems at this point may seem to be a bit technical in this context, but the inclusion is necessary. In addition to forming the

basis for the partitioning of the behavioral stream by means of schedules of reinforcement, the Schoenfeld et al. formulation permits the definition of contingency as "a rule that specifies a temporal relationship between a response and a reinforcer." The significance of the systems becomes more apparent when the topic of relative probabilities is introduced. The two time periods in both scales' cycles are defined in terms of probabilities. By manipulating these probabilities and the lengths of the periods, the behavioral stream can be shaped, partitioned and/or controlled.

The procedures(or operations) by which this is done gives meaning to the term density of reinforcement and facilitates the classification of behavior in terms of behavioral operations rather than behavioral processes. The conceptual base is therefore laid for Catania's(1971) procedural space.

Catania's Procedural Space.

The significance of the Catania procedural space is that it makes use of Schoenfeld, Cumming and Hearst's (1956) analysis of reinforcement schedules to expand the procedural continua. The new continua include not only the operant and respondent behavior that comprises traditional treatments of behavioral operations, but a number of structural and ethological relationships as well. (see figure 3)

Catania, like Schoenfeld et al., maintains that the topographical or physiological properties of responses do not determine whether a given response is an operant or a respondent. The distinction depends upon the relationship of the response to a stimulus within a given experimental

context. It is apparent (see figure 3) that the procedural space accomplishes the classification by (1) using probability as the essential property of stimuli and responses and (2) exhausting the possible S-R combinations.

The use of Premack's R-R system in conjunction with the R-S token schedule and the Cautella procedure(which is probably a mixed S-R, R-S combination) in the two studies above testifies as to the feasibility of the procedural space as both a conceptual and operational tool. Unlike some systems that often concentrate on the analytical power of descriptive behavioral methods, the Catania space gives equal weight to the possibilities of behavioral synthesis. It is of course the power of behavioral programs to modify behavior through the establishment of different behavioral repertoires that justifies its use in the ecological context.

The Resulting Complex.

By reinforcing operant complexes that were incompatible with the idle behavior that is often encountered with high frequency among addicts, the behavioral program produced daily schedules of activities which contained many hours of behaviors that were compatible with the hospital environment. Though no attempts were made to directly modify kinesics which were associated with negative reinforcers, or group spacings which implied hostile social groups and hierarchies, the net result of the program was a decrease in these behaviors on the part of the staff and the patients. The emotional concomitants that Bergman thought important, which nurses and patients expressed as "closer contact" were probably due to the properties acquired by human mediators

in a positively reinforcing environment. The selection of mutually positively reinforcing behaviors and activities as well as the introduction of parallel channels is most likely responsible for "increased communication" and the general ecological adjustments.

The Effects of Drugs.

Rather than viewing these modest programs as equivalent to some kinds of "therapy" it is probably more accurate to observe that they demonstrate that if certain behaviors are placed in contingent relationships with appropriate reinforcers, the addicts can make satisfactory adjustments to their environment. Experience on the ward showed that several patients--despite uncomfortable physiological states--can function in properly ordered environments. A complex balance between drug states, behavior and the environment is reaffirmed by this study. But resources to investigate the complete continua of the Catania space were not available, and the personnel necessary for a complete ecological study was far beyond the operating budget.

Behavioral Ecology.

The Hunt Azrin concept which utilizes experts in different disciplines to solve ecological relationships, and deals directly with the problem relationships has taken behavioral analysis as close as it has come to fulfilling the demands imposed by ecological methods. Tharp and Wetzel's triad (mentioned above) approaches the graphical methods of operations research and the Catania formulation supplies the necessary continuum of behavioral

procedures.

Of course, important relationships between group and social systems must be established before a relatively mature behavioral ecology can be realized. Never-the-less, there are ways of utilizing the knowledge that has been accumulated within the area of systems oriented behavioral research. Unfortunately, the majority of the methods, many of which fall in the area of operations research (see Hillier & Lieberman, 1970) require extensive and often times quite sophisticated quantification of variables.

Since most of the applicable systems in the area surrounding clinical use of social sciences either exist in rudimentary forms of quantification, or lack quantitative formulations, Auerswald's ecological approach was applied here. And Skinner's formulations of operant and pavlovian reflexes were used as structural units which were integrated,by means of several mini-systems, into a delivery system which was applied to the problem of drug addiction.

The consequences of applying this particular system are: (1) the emphasis is on concrete systems and variables rather than abstractions, (2) the system makes use of both convergence in units as well as procedure, (3) It makes possible the concentration and application of a much broader range of behavioral techniques. This makes it possible to cover the area between physiology and sociology with the maximum ability to co-operate with other systems outside of the area. (4) the system is culturally neutral. It could be applied equally well to headhunters as to astronauts, communist or

capitalist, to armies or monks. (5) It makes it possible to integrate an anthropologist's approach to language into the basic structure of psychology. (6) By concentrating on the continuity of social science rather than the differences and on synthesis and construction rather than criticism, it avoids many useless conflicts and reduces actual differences to minimum. (7)It permits the use and measurement of techniques which are in very primitive stages of quantification.

As more and more mini-systems and unifying frameworks come into use, there appears to be a convergence toward a macro-probabilistic and descriptive treatment along ecological continua. So despite the fact that the structural approach used here differs markedly from that of Brunswick, (1955) I am forced to accept both the convergence and the "E-E" frame of reference which Brunswick predicted. This is in disagreement with Barker (1960).

Perhaps the most important contribution that this study can make is in the field of interdisciplinary co-operation. No matter how broad, central, or important the behavioral level of analysis becomes, there are still some rather important variables that are not covered by our units. We are, in these areas, dependent upon the studies conducted by other scientist, scientist with whom we must co-operate in order to preserve and/or create a harmonious relationship with our many environments. Using analogies from other disciplines is obviously not the answer. Ther should however, be a point of convergence where co-operation is possible. And the ecological method is one way of searching for it.

The result of a concerted interdisciplinary effort will probably be a general anthropology based on probability relationships and resembling General Systems Theory. In short:

> I believe that there are certain principles in common in an emerging psychology of man or, as we should rather say, in a new science of man or general anthropology, because this will obviously be an interdisciplinary enterprise including biology, psychiatry, sociology, linguistics, economics, the arts and other fields. (Marschall McLuhan and Quentin Fiore).

FIGURES AND TABLES

Figure 1.

An organization chart showing the evolution of the ward form during the amphetamine studies. Though the changes in the position of the behavioral analyst and the clinical doctor are quite apparent, the differences in mediating function are not shown in this form of presentation.

Figure 2.

The three phase amphetamine program is presented by the digraph and matrix. The phases: (P/1) detoxification, (P/2) treatment, and (P/3) rehabilitation are presented by the vertices while the possibilities of passing from one phase to another are represented by the arcs. The matrix gives the same information with the phases being represented by their respective numbers.

Figure 3.

Catania's procedural space classifies the possible behavioral procedures within the framework of operational continuum. Probability relationships are used to exhaust the possible S-R combinations.

Figure 4 and Table 4.

The mathematical description of schedules of reinforcement by use of digraphs. The transititions and stimuli are specified in the table.

Figure 5.

The graphical representation of the consultative triad which is the fundamental organizational unit used in modification in an ecological context.

Figures 13-23-

Figures 13-23 should be read from left to right. Beginning with the scale on the left and ending with the first vertical line is section "A" which shows baseline peformance. Section "B" begins with the second vertical line and ends with the third. It shows the performance during the first week of the program. The third section "C" shows what happens when behaviors are not reinforced. Section "D" shows the normal functioning of the program. And "E" shows a purposeful manipulation and "F" back to normal. In summary, the graphs simply show that there is a functional correlation between the token system and the behavior.

Figures 24-25.

Figures 24-25 show points of convergence which were used in the formulations of the author whose name is in capital letters.

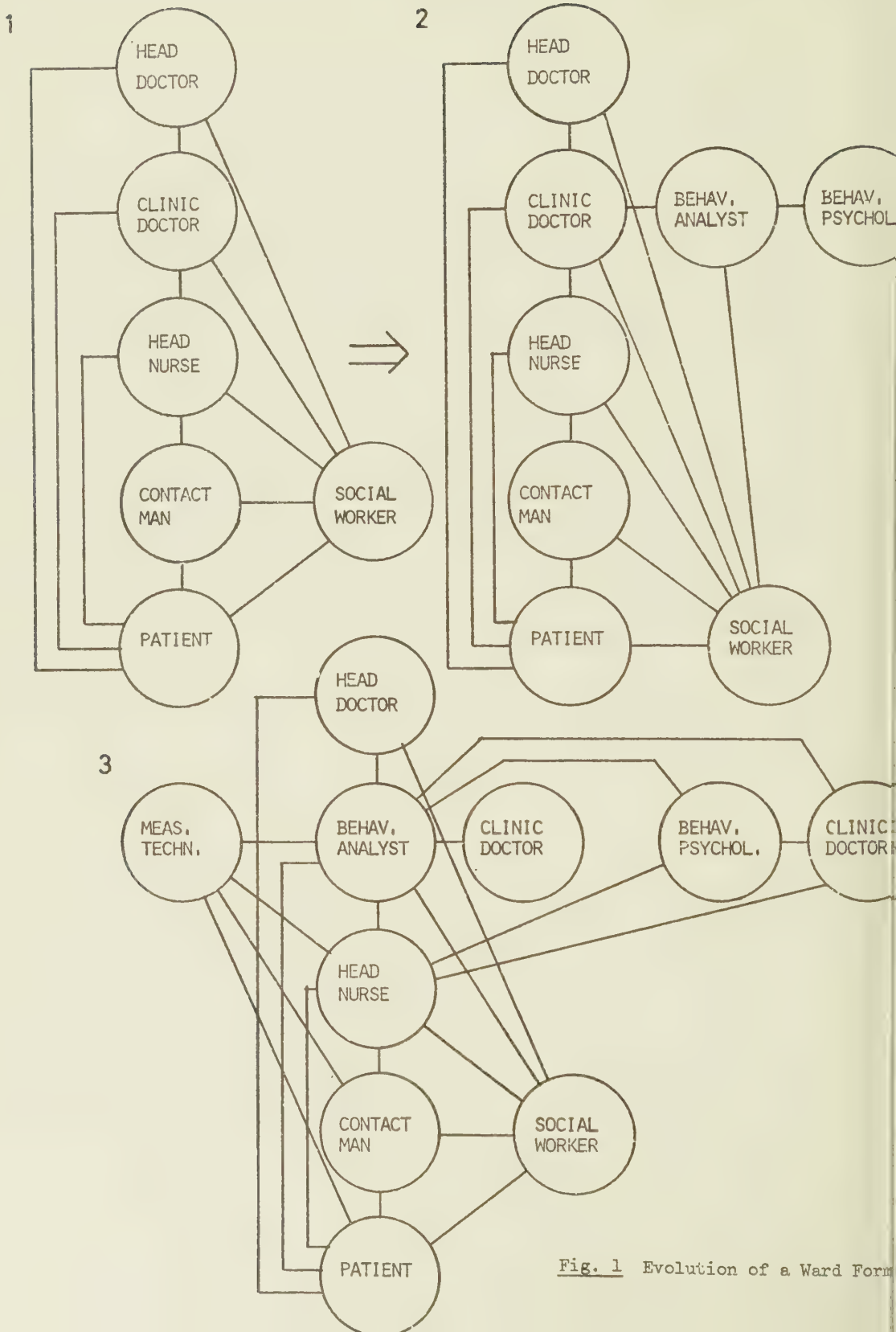
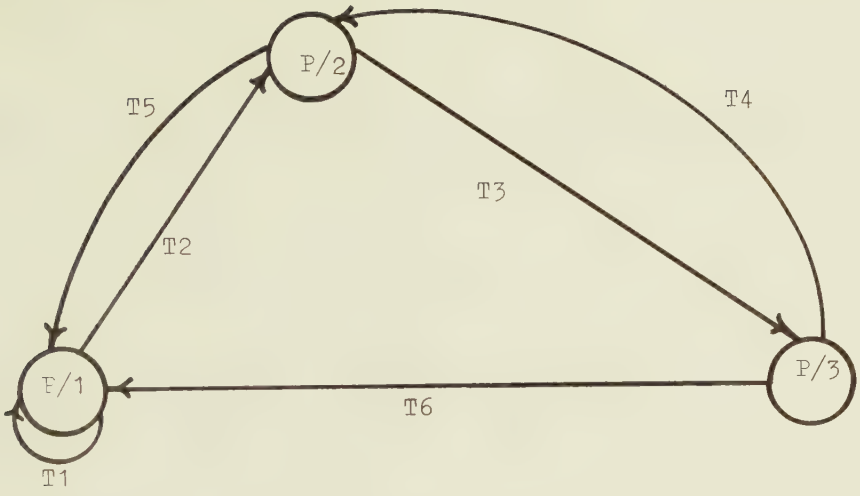


Fig. 1 Evolution of a Ward Form



	1	2	3
1	1	1	1
2	1	0	1
3	1	1	0

Figure 2 Digraph of amphetamine program and matrix.

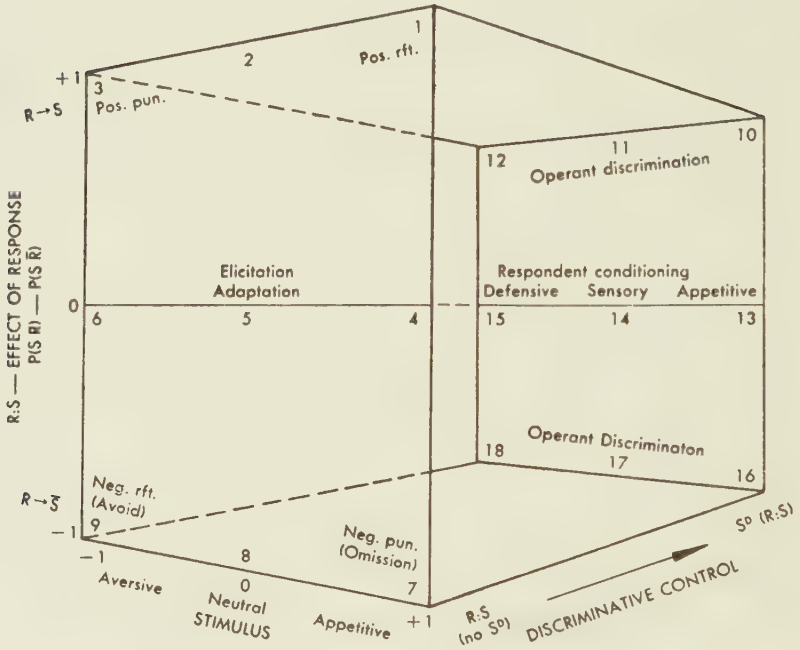


Figure 3 The Catania Procedural space. Taken from Catania(1971)

TABLE 8-1 Transitions and Stimuli for Generalized State Graph of 12 Reinforcement Schedules

Schedule	E_1	E_2	E_3	E_4	E_5	E_6	S_1	S_2	S_3
Pavlovian	T_1			T_2	T_3		Background	CS	UCS
Discriminated avoidance	T_1		R	T_2	T_3		Background	CS	UCS
DRL	T_1	R		R	E		Background	Background	S^R
Sidman avoidance	T_1	R		T_3	R	T_2	Background	S–	Background
FI	T_1			R	E		Background	Background	S^R
VI	VT_1			R	E		Background	Background	S^R
FI–LH	T_1		T_2	R	E		Background	Background	S^R
VI–LH	VT_1		T_2	R	E		Background	Background	S^R
FR	$(N-1)$R			R	E		Background	Background	S^R
VR	$V(N-1)$R			R	E		Background	Background	S^R
DRH	R		T	R	E		Background	Background	S^R
Delayed reinforcement	R			T	E		Background	Background	S^R

Table to Fig. 4

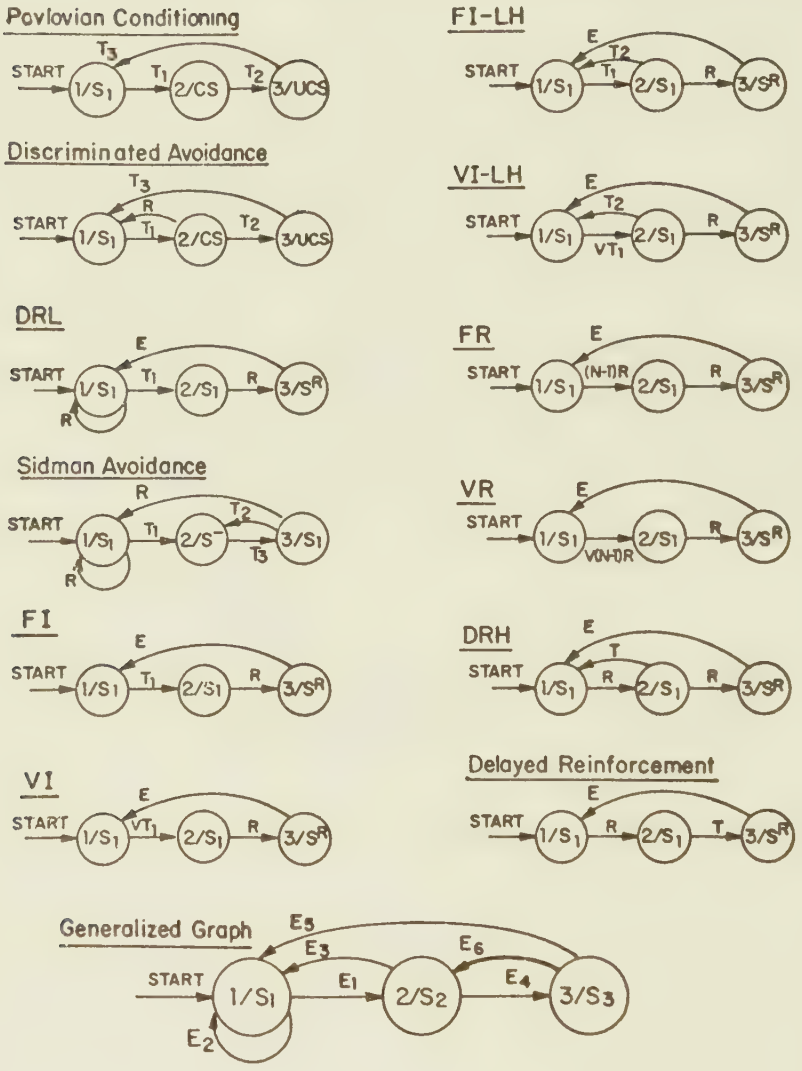


Figure 4 Taken from Snapper et al.(1970)

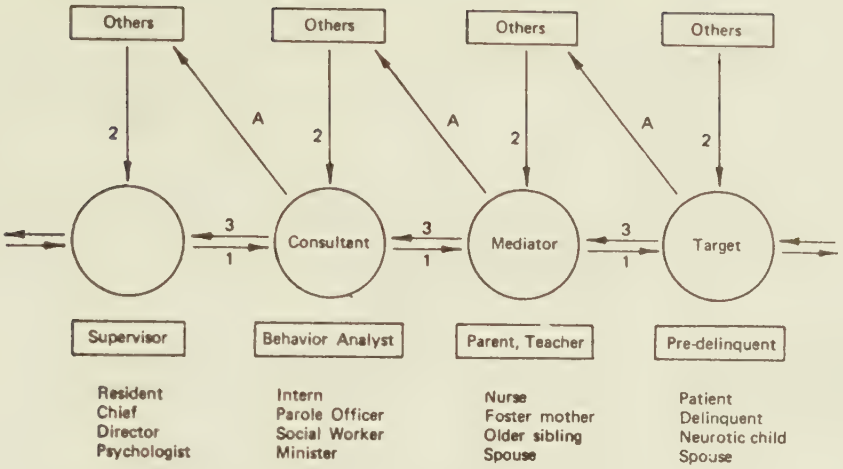


FIG. 7. The consultative triad embedded in the social environment.

Figure 5 From Tharp & Wetzel(1969)

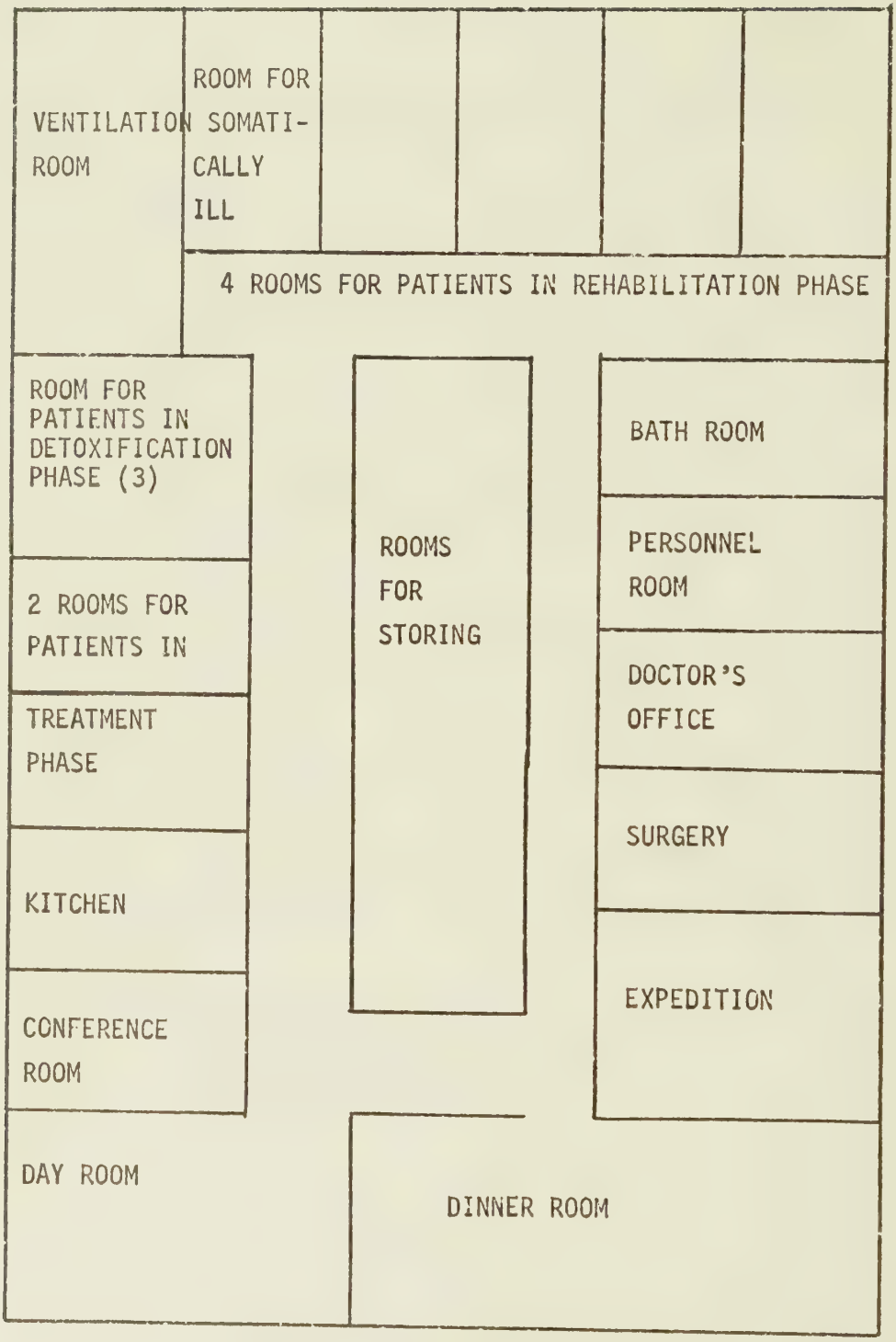


Fig. 6. Scheme over the ward.

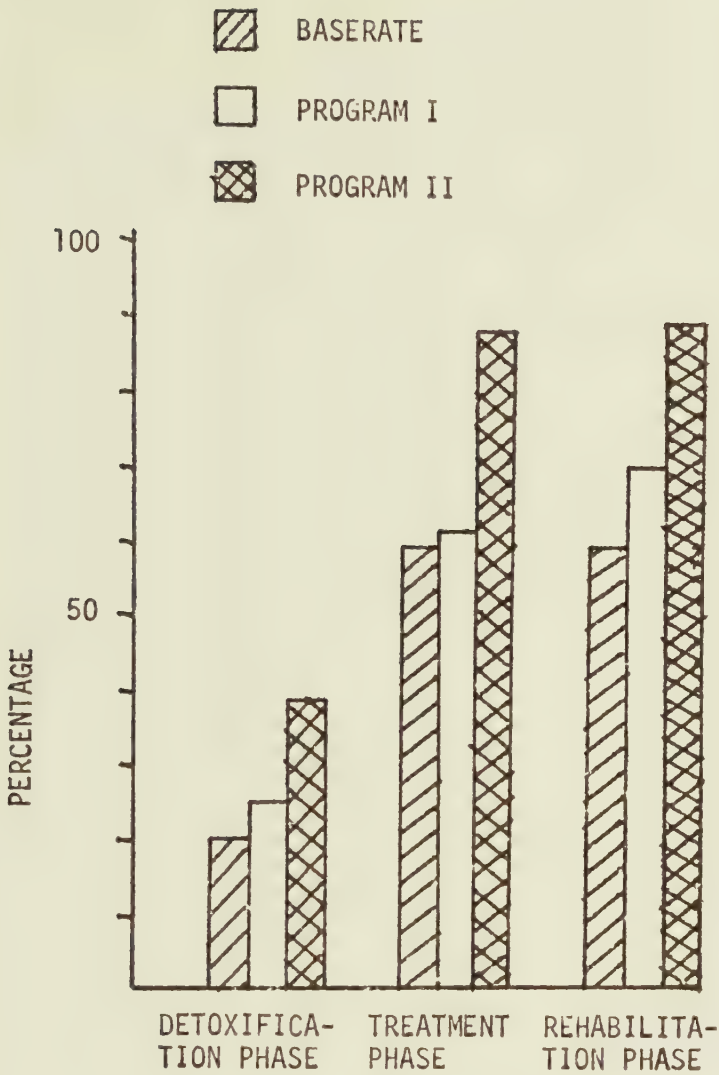


Fig. 7. Percentage patients up, dressed and having made their beds before 8 a m.

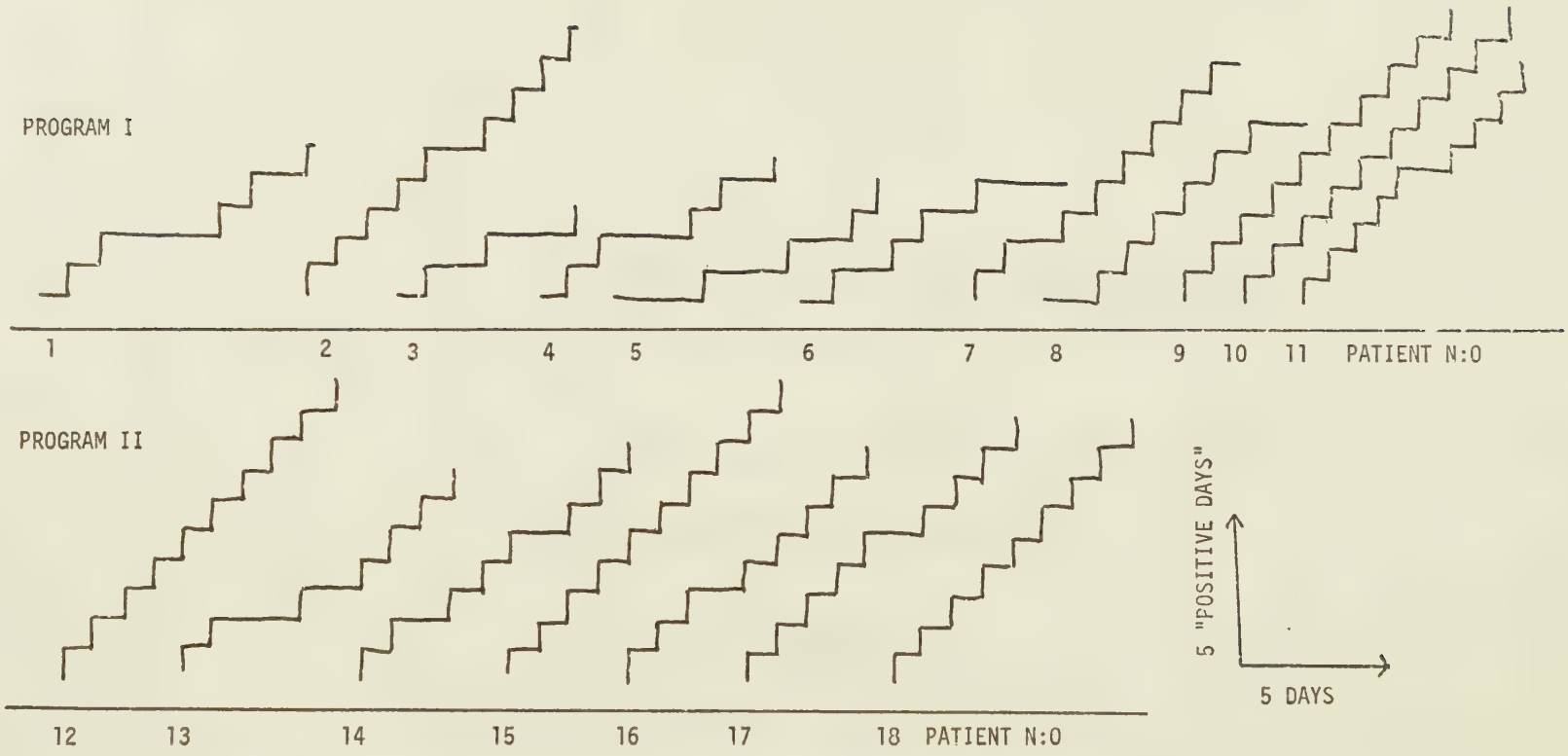


Fig. 8. Cumulative representation of patients up, dressed and having made their beds before 8 a m (same data as in fig. 7). Number of days in the horisontal direction, number of "positive days" (where all the criteria fulfilled) in the vertical direction.

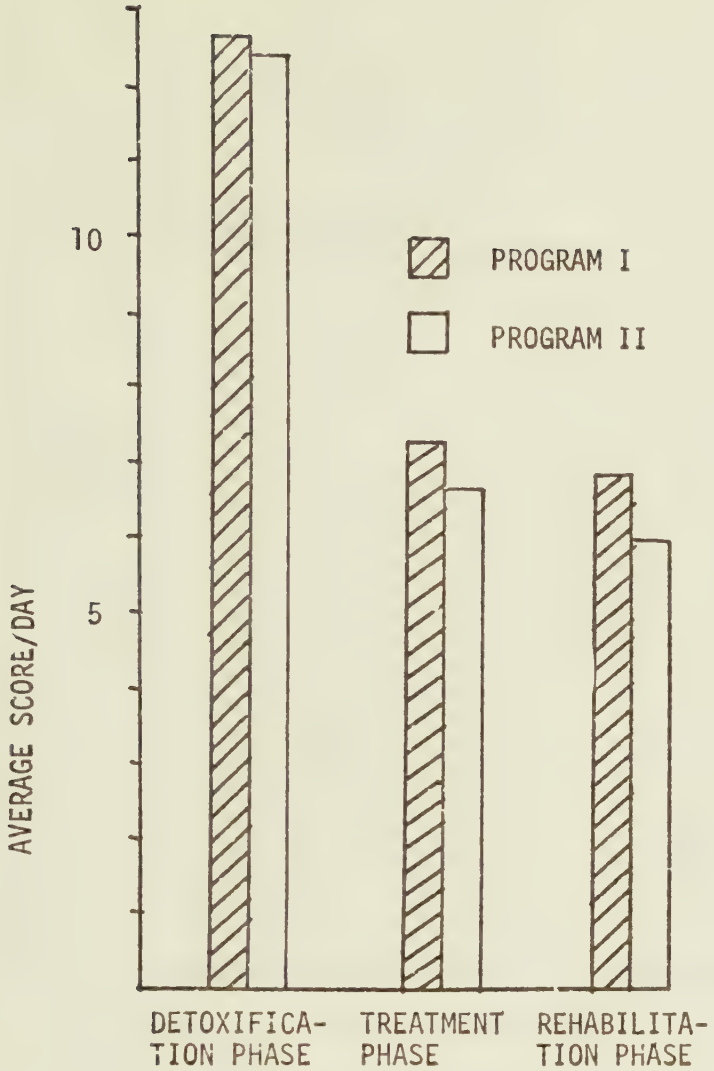


Fig. 9. Average frequency of scores: "In private room" (maximum number of scores possible 21).

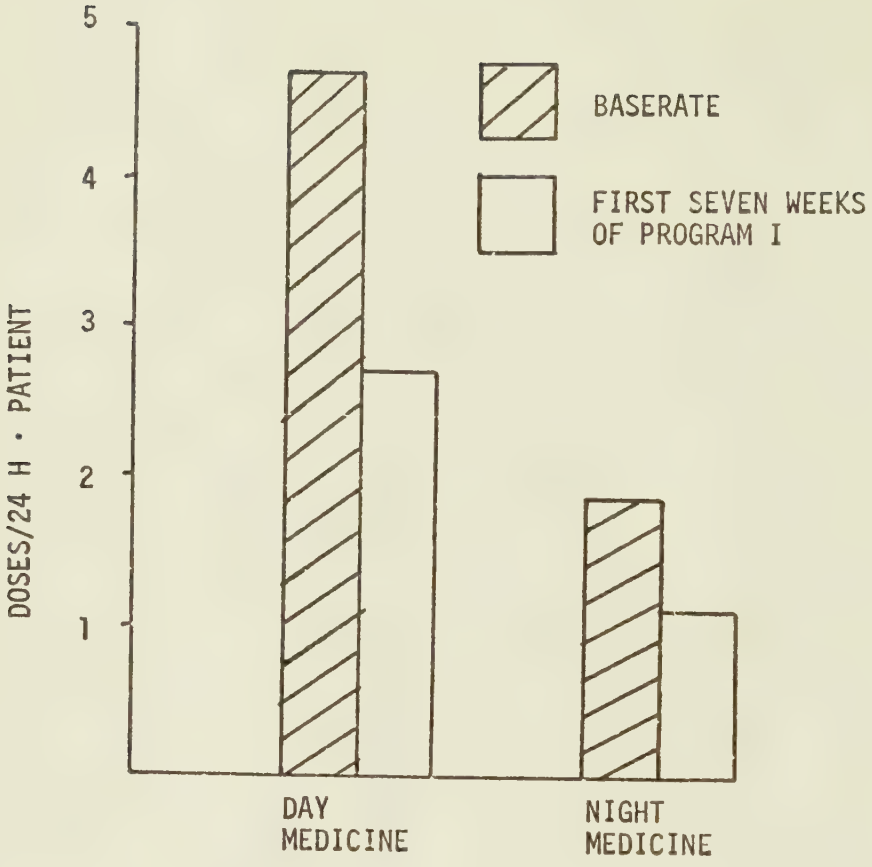


Fig. 10. Comparison of drug prescription on ward before and after initiation of program I.

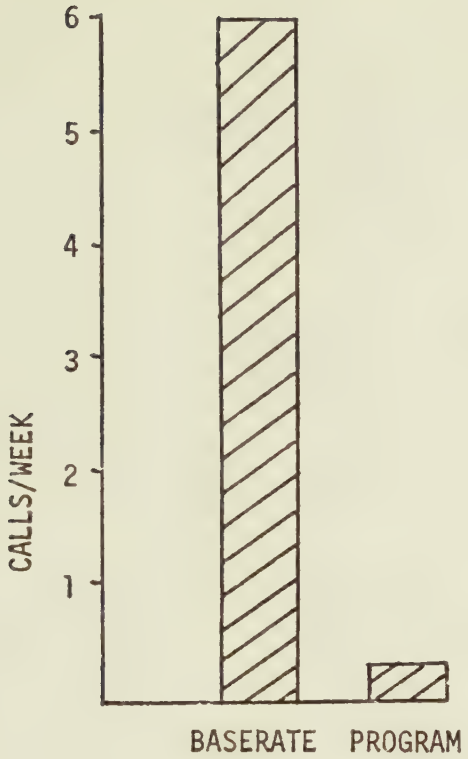
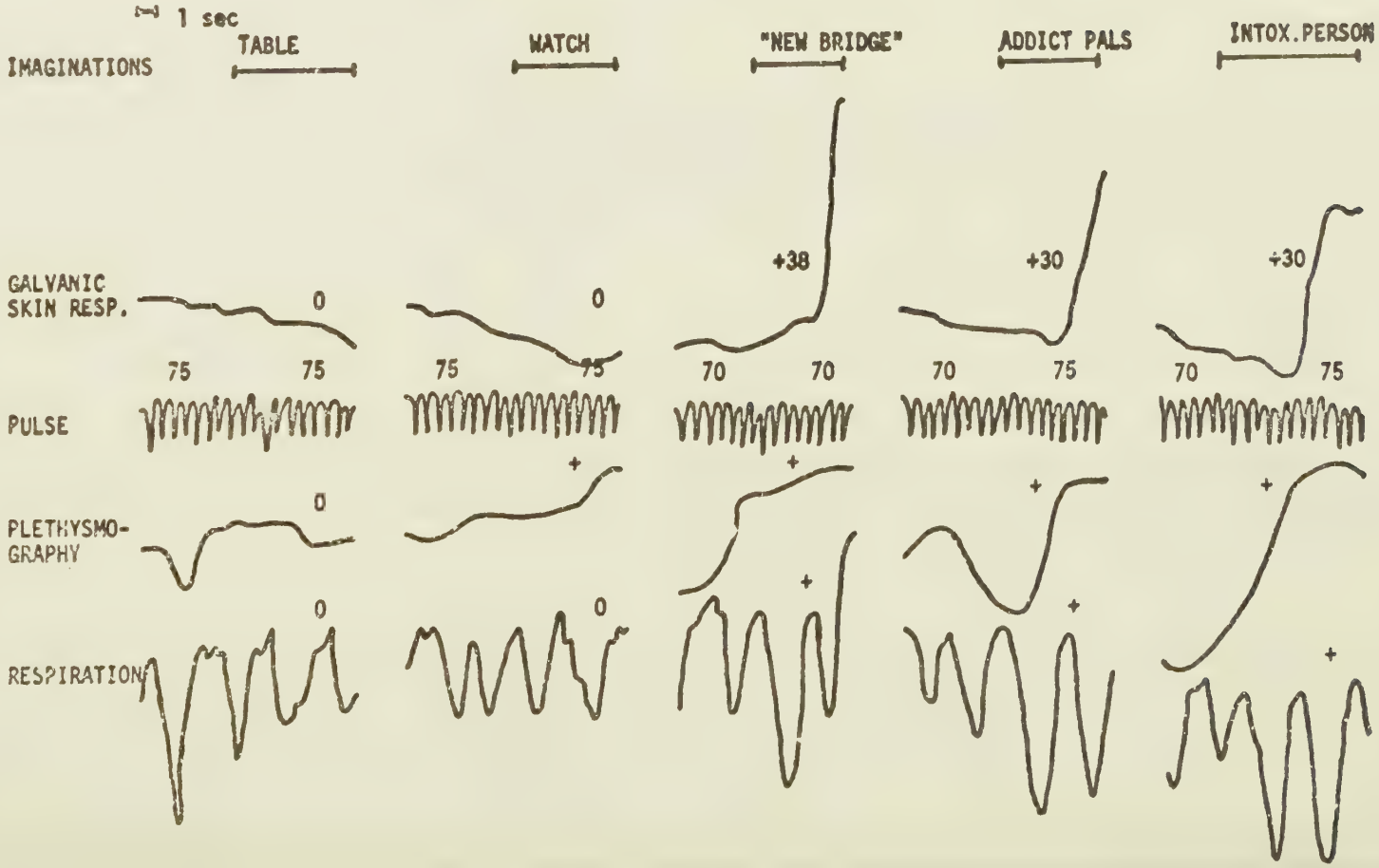


Fig. 11. Times per week the doctor, when at home, got a call from the ward. Baserate before program, first seven weeks of program I.

Fig. 12. Physiological registrations (GSR, Pulse rate, Plethysmography, Respiration) of one of the patients (case 2) imaginating different items and situations, before the start of the "covert extinction"treatment.



1. UP AND DRESSED IN THE MORNING

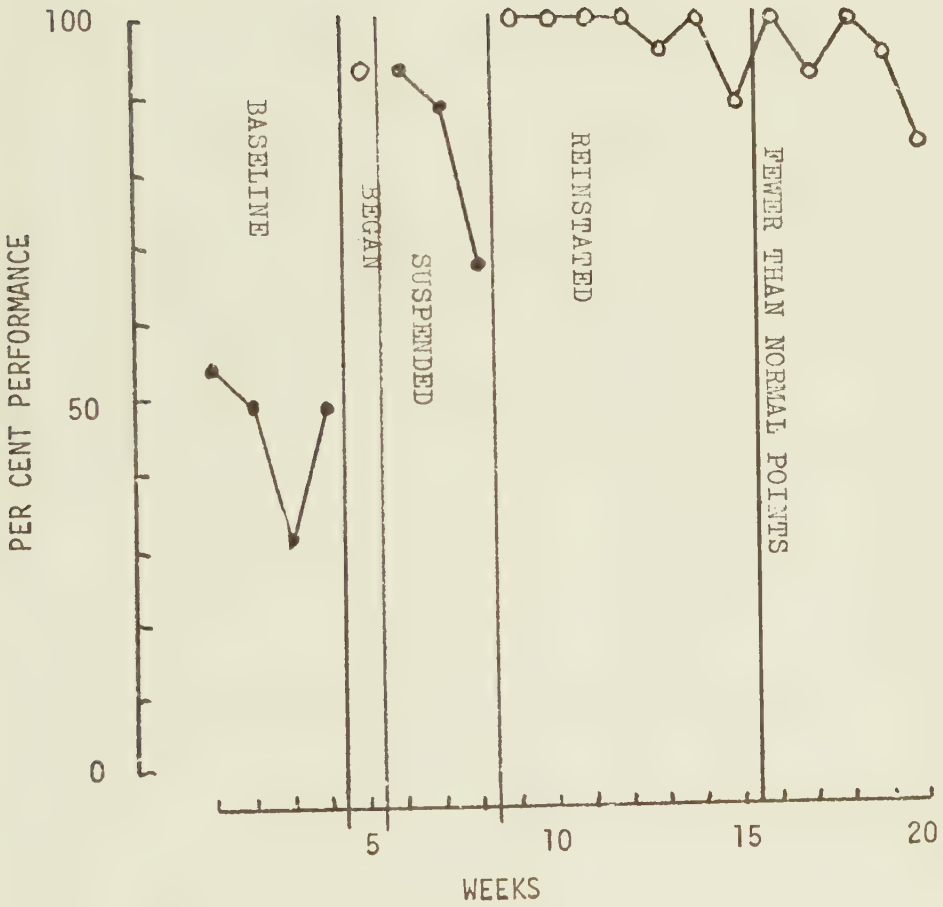


Fig. 13

2. MAKING BED IN THE MORNING

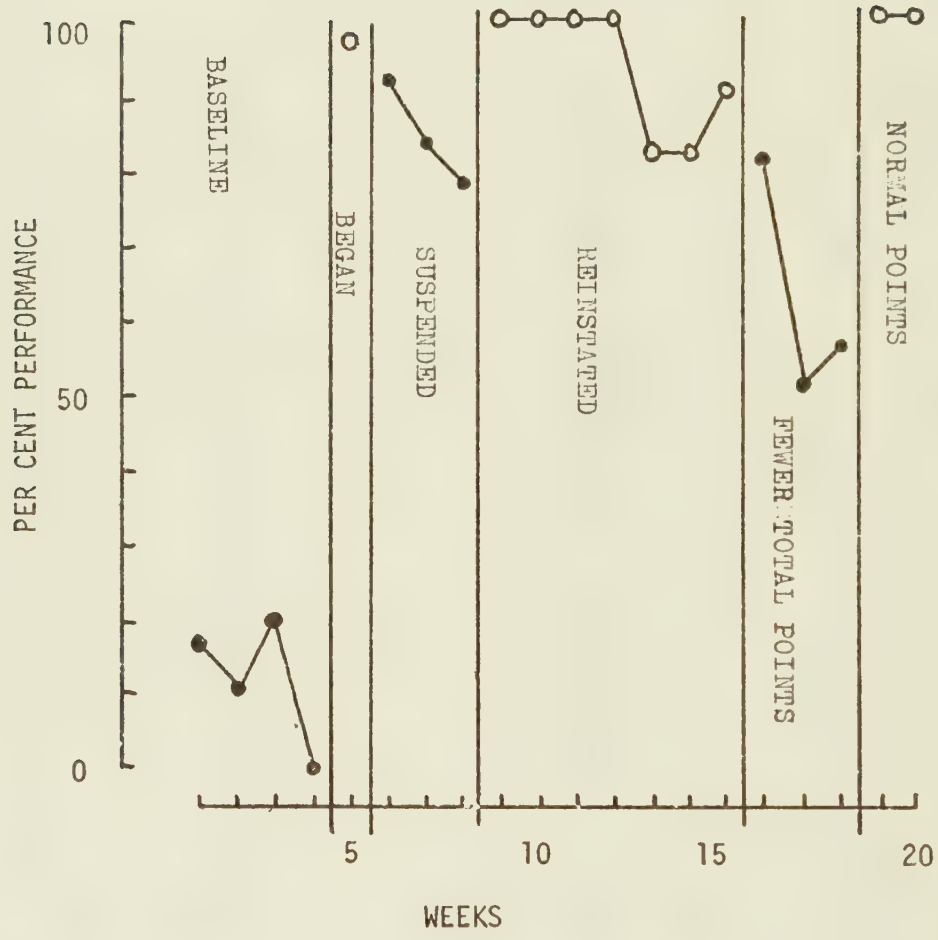


Fig. 14

3. PARTICIPATION IN MORNING CONFERENCE

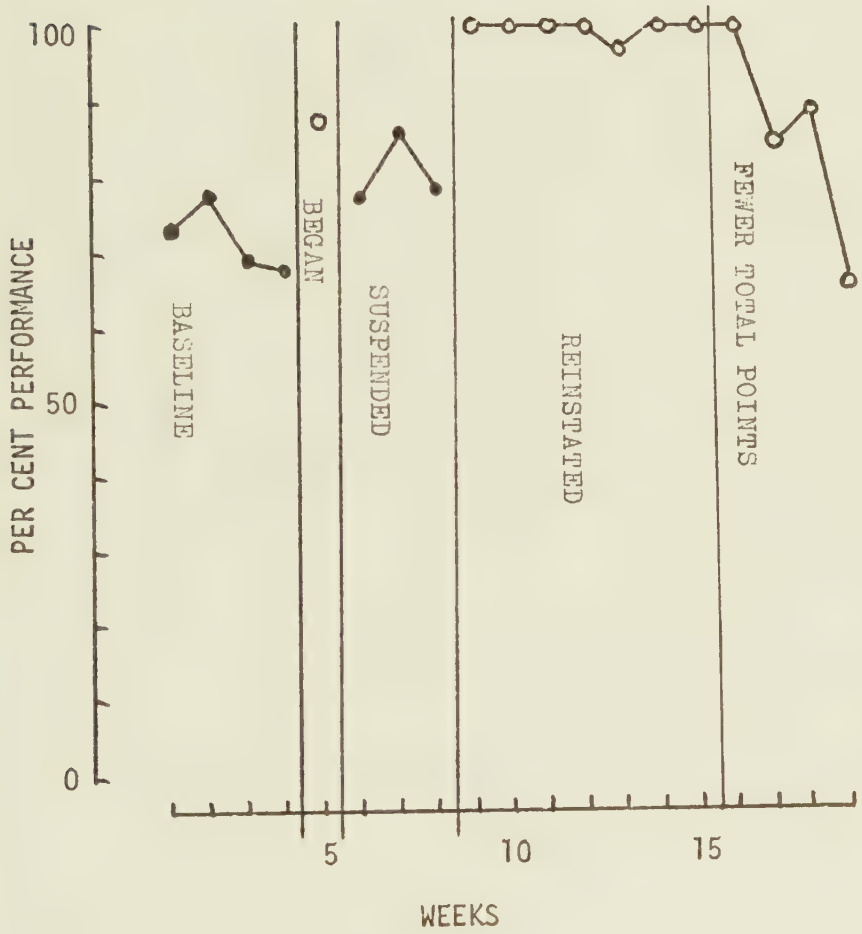


Fig 15

4. WORK ON THE WARD

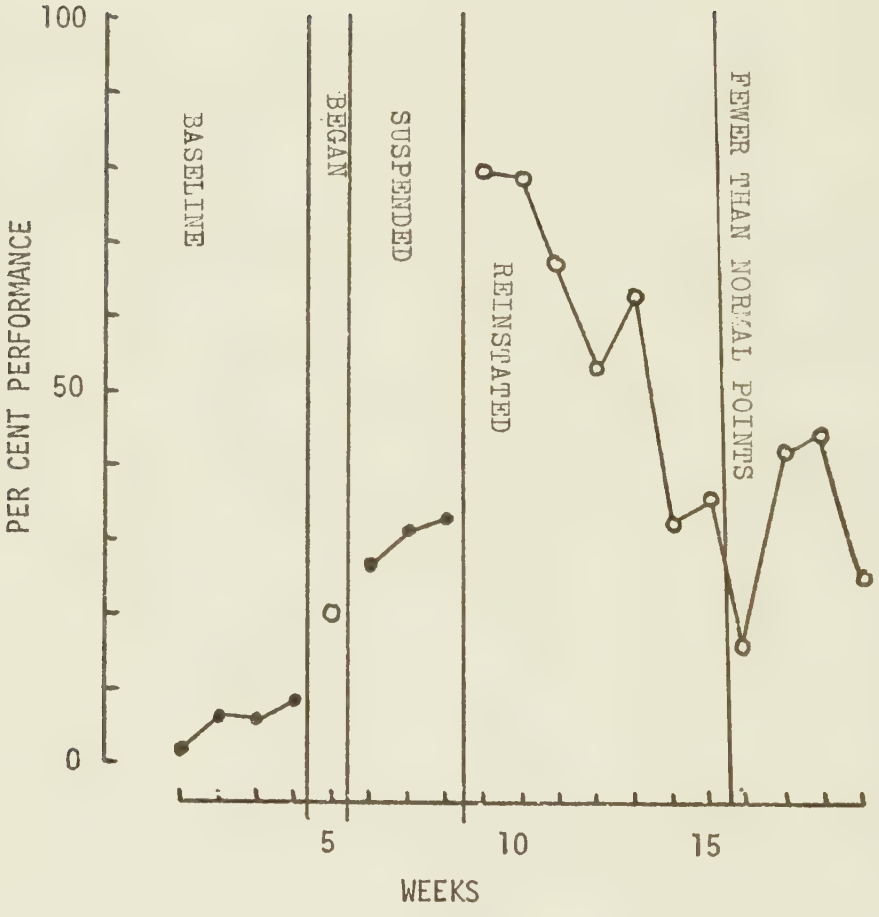


Fig 16

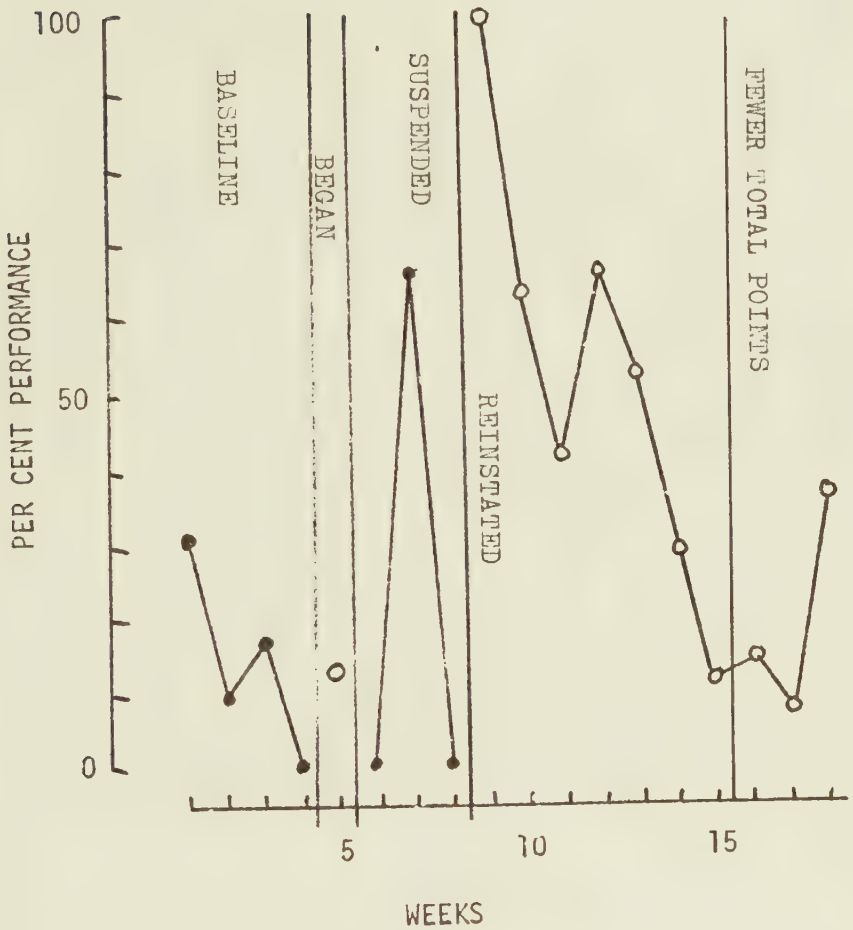

100
50
0
PER CENT PERFORMANCE
BASELINE
BEGAN
SUSPENDED
REINSTATED
FEWER TOTAL POINTS
5
10
15
WEEKS

Fig 17

6. GYMNASTICS

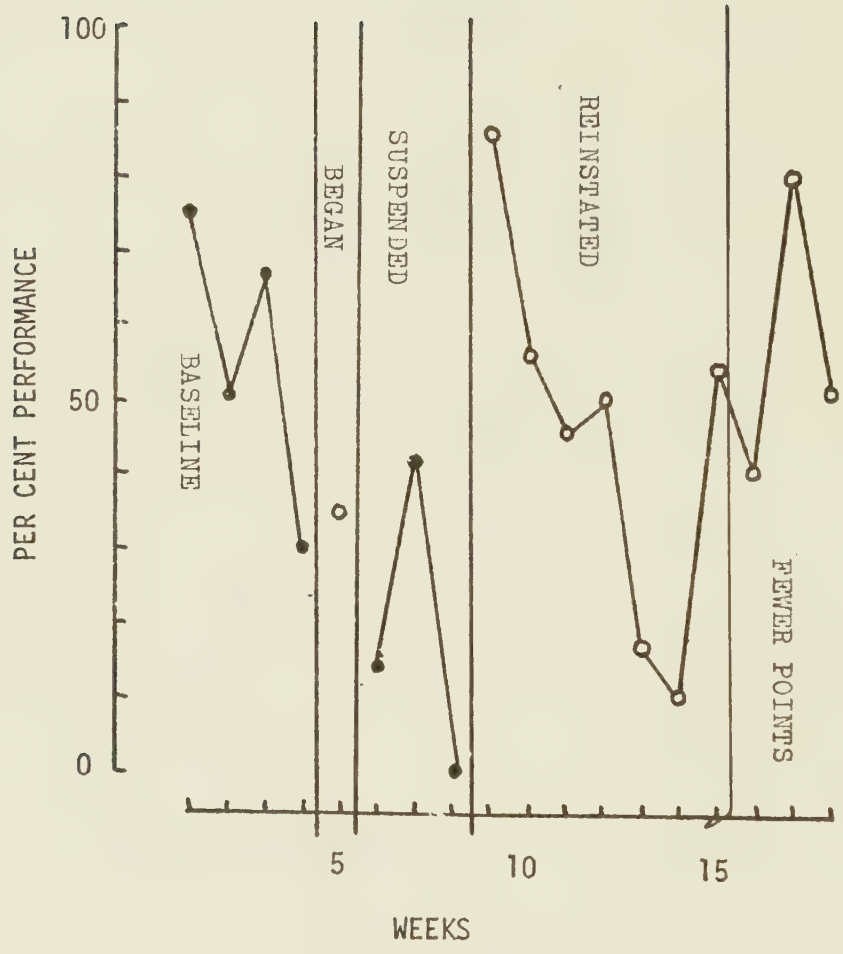


Fig 18

7. WALKS

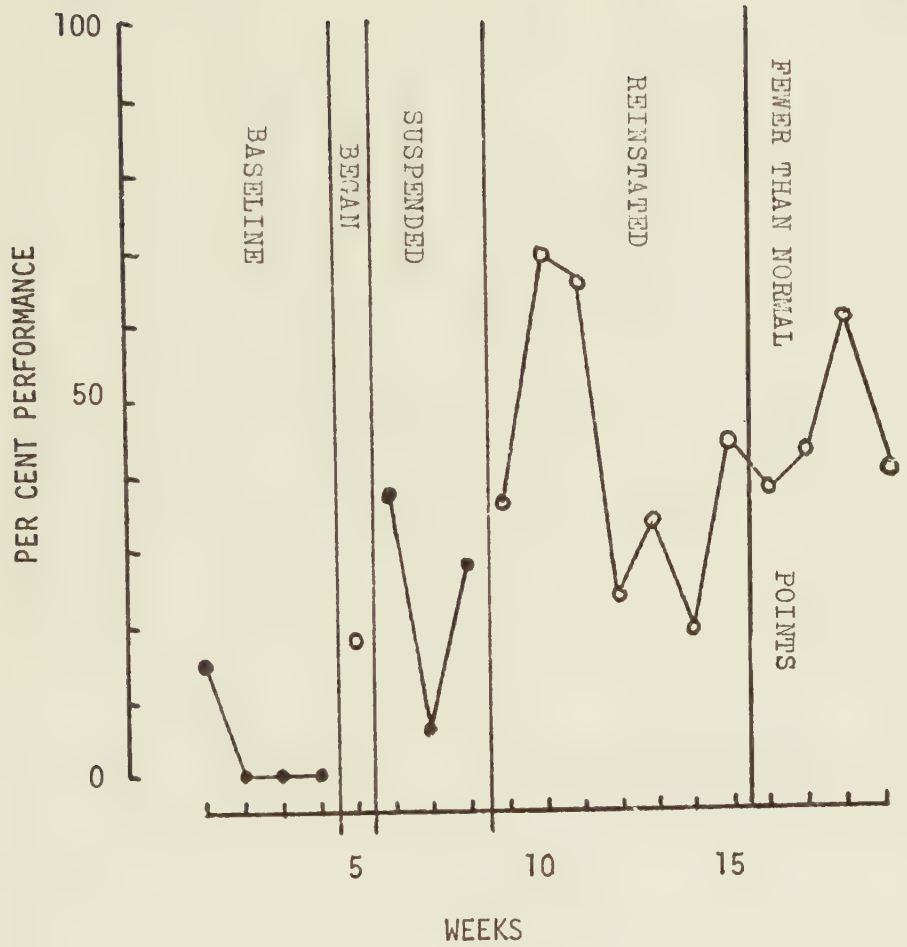


Fig 19

8. BATH EXCURSION

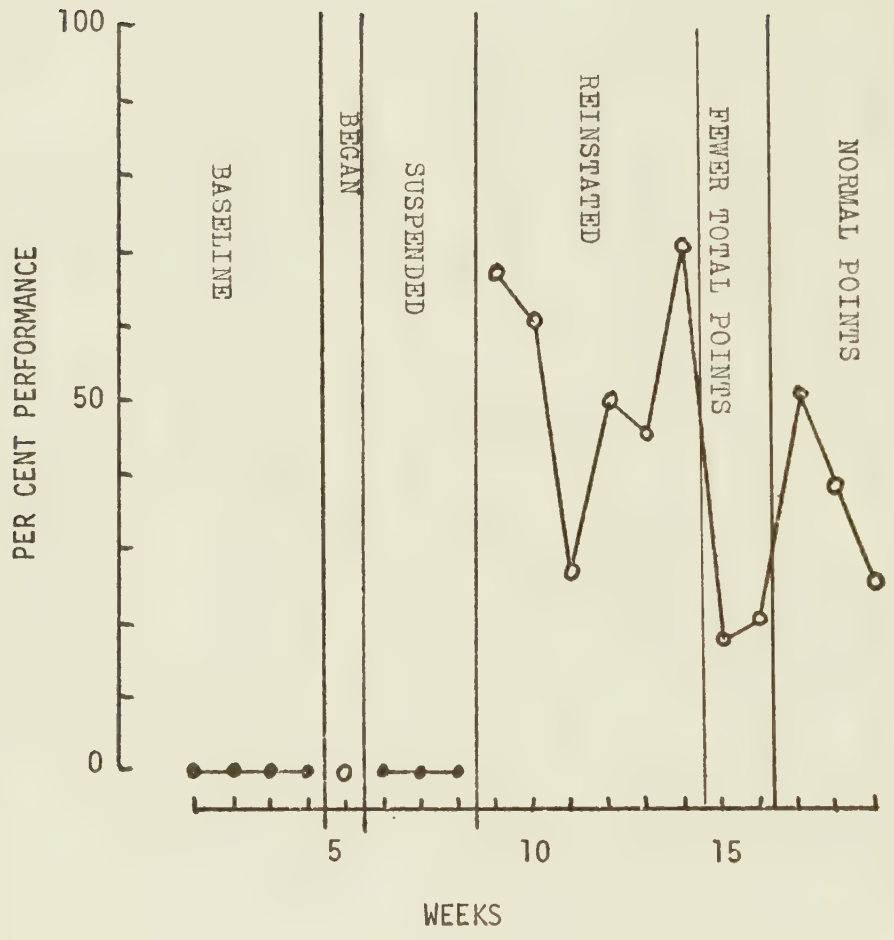


Fig 20

9. COOKING COURSE

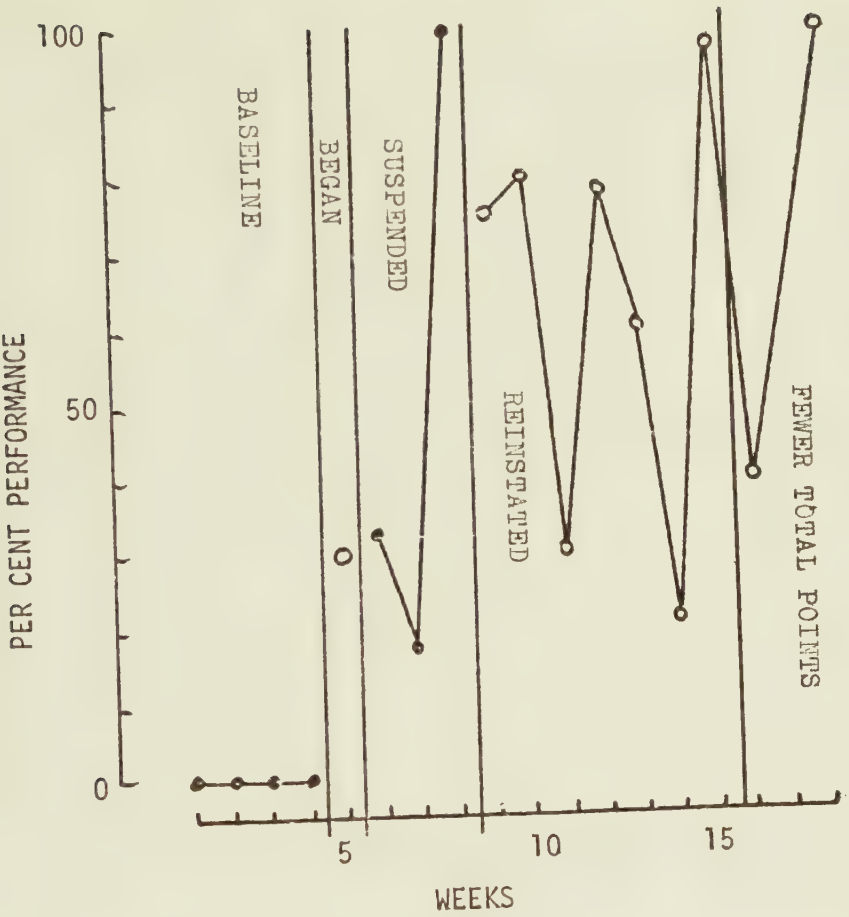


Fig 21

TOTAL AMOUNT OF POINTS PER WEEK PER PATIENT

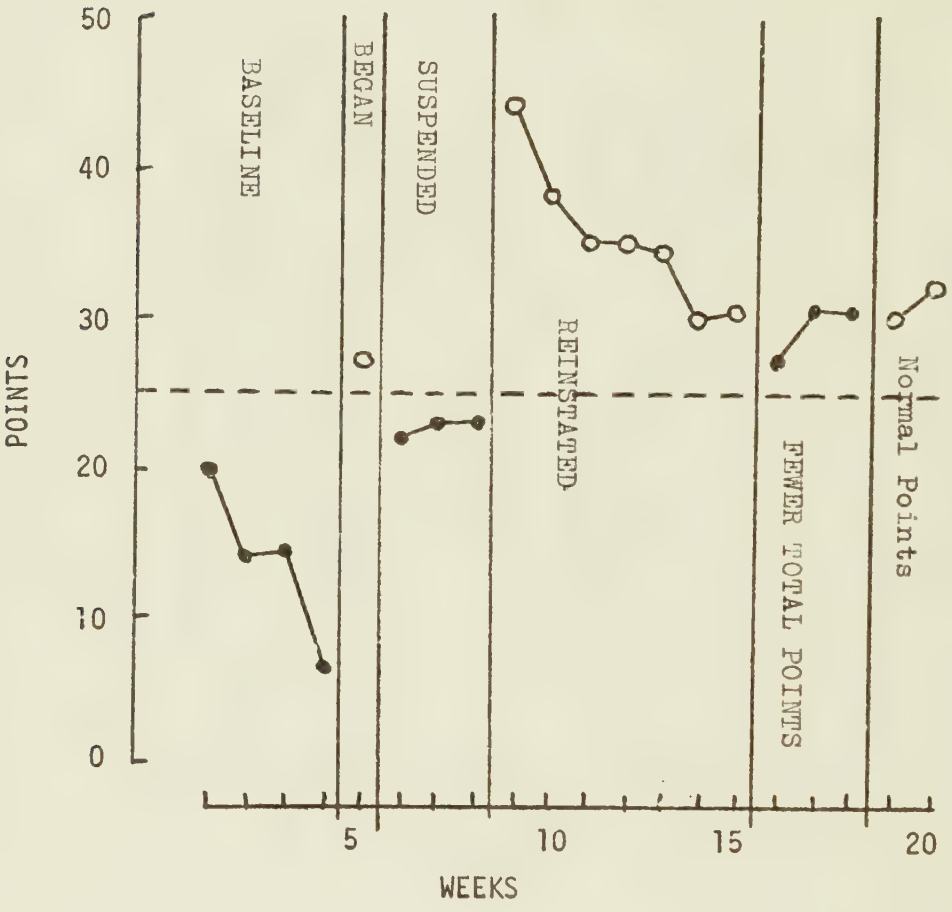


Fig 22

TOTAL PROPORTION OF PATIENTS PASSED CRITERION

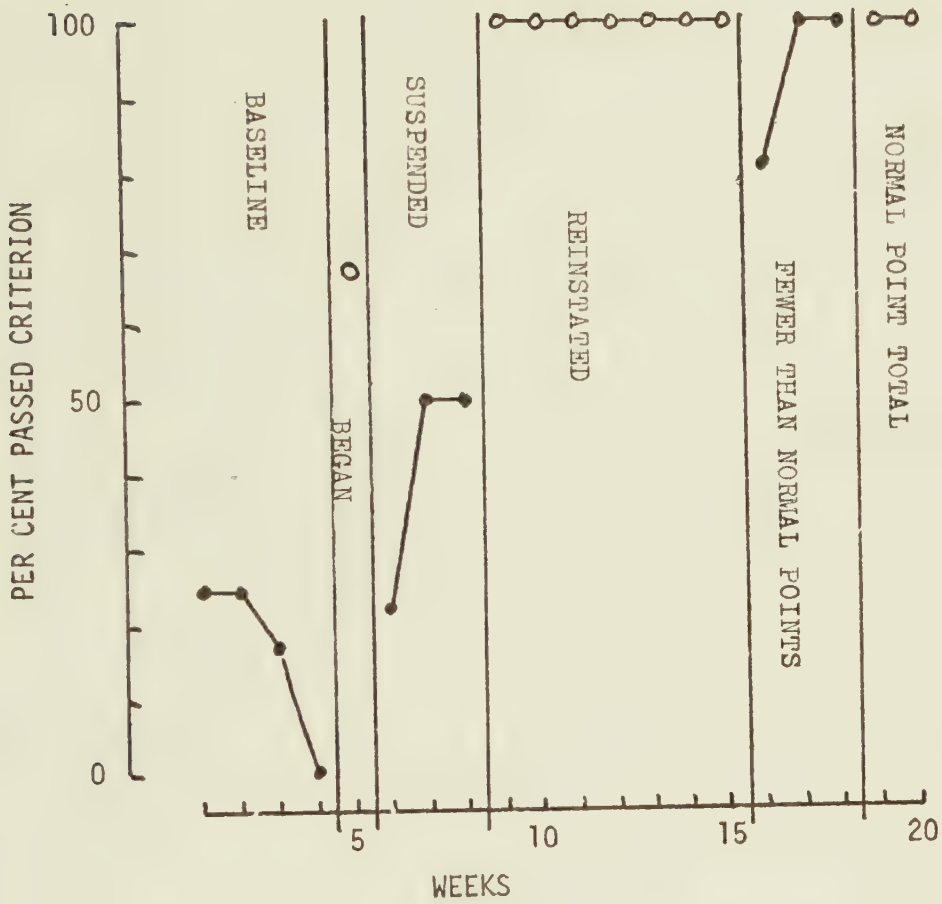


Fig 23

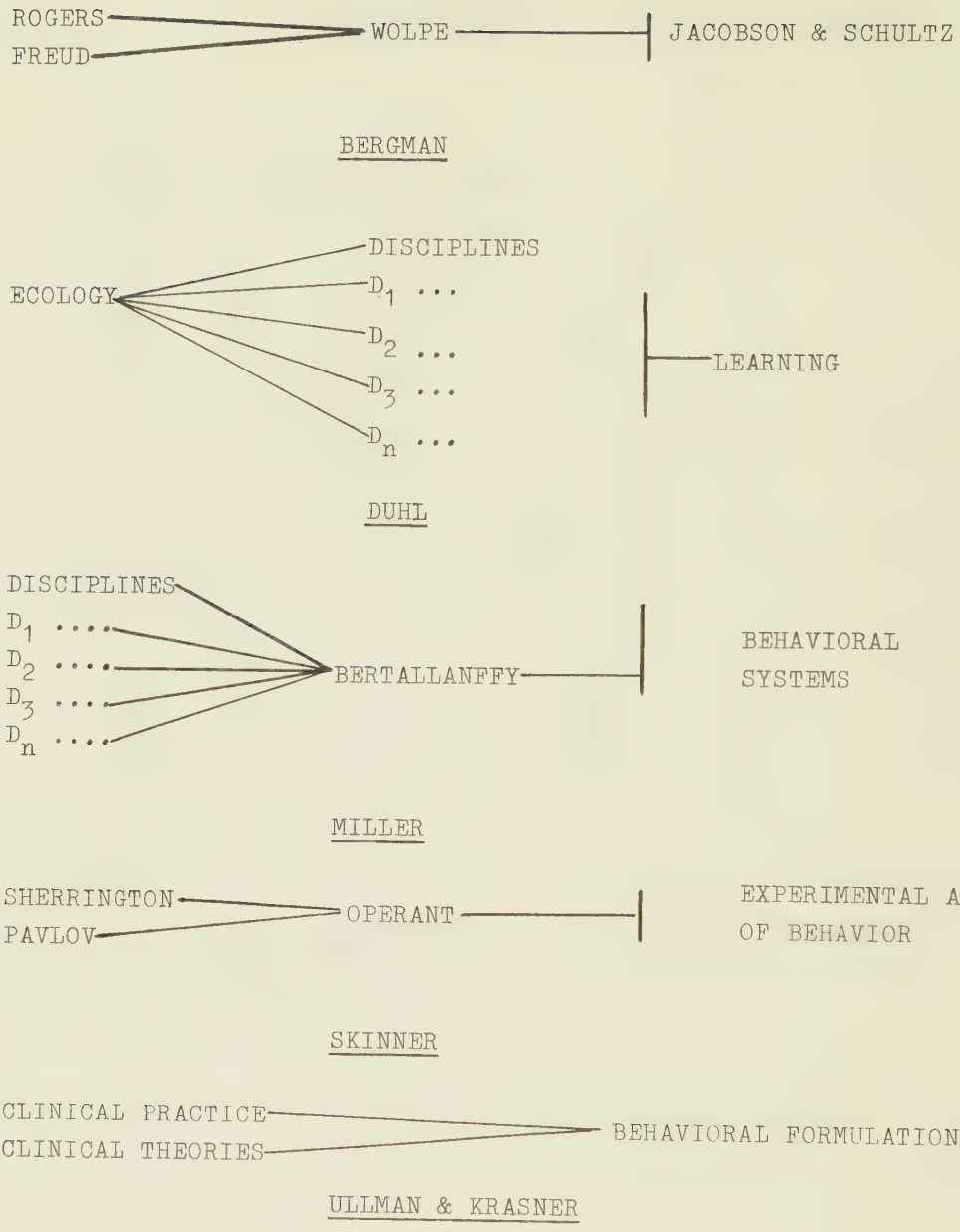
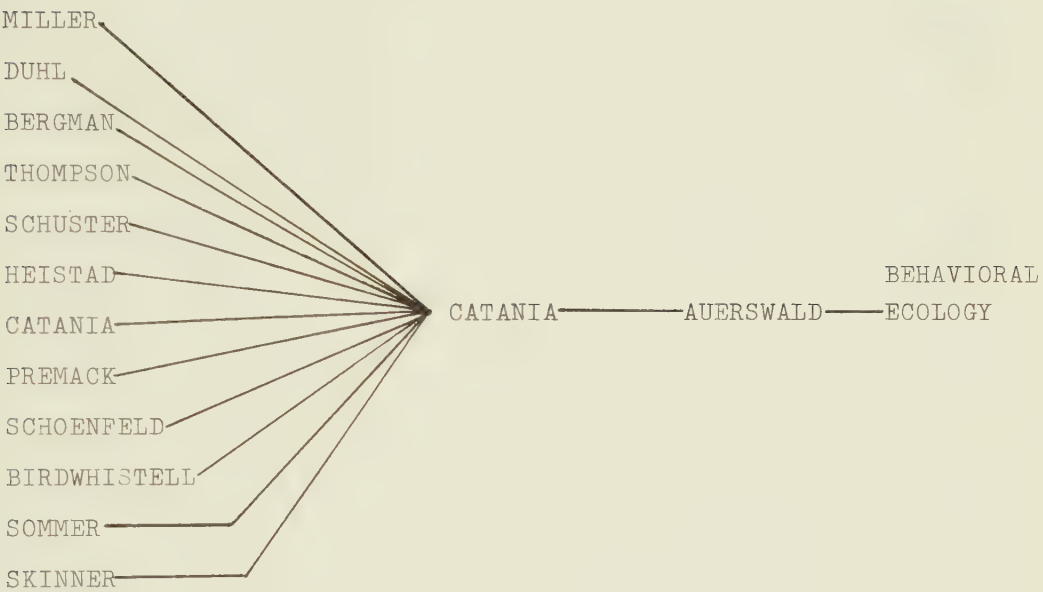

ROGERS
FREUD
WOLPE
JACOBSON & SCHULTZ
BERGMAN
ECOLOGY
DISCIPLINES
D_1 ...
D_2 ...
D_3 ...
D_n ...
LEARNING
DUHL
DISCIPLINES
D_1 ....
D_2 ....
D_3 ....
D_n ....
BERTALLANFFY
BEHAVIORAL SYSTEMS
MILLER
SHERRINGTON
PAVLOV
OPERANT
EXPERIMENTAL ANALYSIS OF BEHAVIOR
SKINNER
CLINICAL PRACTICE
CLINICAL THEORIES
BEHAVIORAL FORMULATIONS
ULLMAN & KRASNER

Figure 24


MILLER
DUHL
BERGMAN
THOMPSON
SCHUSTER
HEISTAD
CATANIA
PREMACK
SCHOENFELD
BIRDWHISTELL
SOMMER
SKINNER
CATANIA
AUERSWALD
BEHAVIORAL
ECOLOGY

DOCKENS III

Table I

Activity	Points	Times per week	Max points per week
Up and dressed before 8 A.M.	1	6	6
Room cleaned before 10 A.M.	1	6	6
Daily planning Conference 8:15 A.M.	2	6	12
Work on the Ward	1	5	5
Occupational therapy	2	3	6
Gymnastics	3	2	6
Half hour walks(with staff)	1	5	5
Swimming trips	2	2	4
Cooking course	1	1	1

Table II

Points Required	Type of Leave
0	Walk with staff member
25	Leave until 6 P.M.
50	Leave until 11 P.M. or whole day, Allowed to receive visitors.
75	Same as above but: two whole days leave.§
100	Same as above but: three whole days leave.§

§Sufficient methadone was given to last until return to hospital.

Table III

Relations between high frequency behaviors and low frequency behaviors in the rehabilitation phase.

Low Frequency Behaviors	High Frequency Behaviors (Reinf.)
1. Up in the morning 8 a.m. (dressing, making bed, cleaning up).	1. Staying in room with two beds
2. Attending morning conference	
3. Routine work on ward (with contact man) (Scouring, sweeping, dusting)	2. Leaving ward for walks with personnel
4. Physical therapy	
5. Covert conditioning	

Low Frequency Behaviors	High Frequency Behaviors
1. Up in the morning 8 a.m. (dressing, making bed, cleaning room)	1. Staying in private room
2. Attending morning conference	2. Leaving ward for a few hours without personnel.
3. Routine work on ward (with contact man) (Scouring, sweeping, dusting)	3. Leave for a whole day or more
4. Physical therapy	4. Taking visitors in own room during the afternoon
5. Covert conditioning	
6. Activity 2 - 4 could be exchanged for off ward activities i.e. work in hospital area or in town.	

Table IV

Activity schedule. Five points needed for moving from detoxification phase (I), 25 points for moving from treatment phase (II),and 25 points a week for staying in rehabilitation (III).

Phase	Activity	Points	Times per week	Maximum p per week
I+II+III	Dressed before 8 a m	1	6	6
	Made bed & room 9 a m	2	6	12
II+III	Work 1	1	2	
	Work 2	1	2	6
	Work 3	1	2	
	Working Therapy	2	3	6
	Gymnastics	3	2	6
	Bath Excursion	2	2	4
	Cooking Course	1	1	1
	Wednesday Conference	1	1	1
	Searching for Work	4	1	4
III	Working	5	5	25

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